Article

Medicate to Graduate: Academic Strain and Nonmedical Prescription Stimulant Use Among Graduate and Undergraduate Students

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Abstract

The nonmedical use of prescription stimulants has been prevalent on college campuses in recent years. Previously, nonmedical prescription stimulant use (NMPSU) has been associated with increased use of other illicit substances, drug abuse, school dropout, and arrest. It is, therefore, imperative to understand the etiology of NMPSU for prevention, intervention, and harm reduction purposes. This study builds upon previous research on the role of academic strain in NMPSU by (a) considering a measure of strain that is more consistent with strain theory and (b) extending the examination to include graduate students. By utilizing an original data set of 1,121 undergraduate and graduate students at a Southern urban university, our overall results are consistent with general strain theory but mixed with respect to the role of academic strain in particular. The implications of our study for academic strain are discussed.

Keywords

nonmedical prescription stimulant use, prescription stimulant misuse, strain, academic strain, general strain theory, graduate students

Introduction

While the use of most illicit drugs has generally declined over the course of the previous decade (Johnston et al., 2016), nonmedical prescription stimulant use (NMPSU) has grown and now remains at a disproportionately high rate among college students in comparison to their noncollege peers, young adults in general, and high school seniors nationwide (e.g., Johnston et al., 2016; McCabe et al., 2018; Substance Abuse and Mental Health Services Administration [SAMHSA], 2019; Wilens et al., 2008).[1,2] Contributing to these trends is the observation that prescription stimulants are readily available for nonmedical use on many college campuses

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(McCabe, Boyd, & Teter, 2006; McCabe et al., 2018; Rabiner et al., 2008; SAMHSA, 2019; Wilens et al., 2008) likely due, in part, to the fact that the psychopharmacological effects are believed to aid in the achievement of conventional academic goals and objectives (Arria & DuPont, 2010).

Along these lines, instrumental motivations for misuse appear common. As described by Goode (2019), individuals who use substances for instrumental reasons do so under the belief that they will be able to more effectively achieve some goal or greater purpose rather than for any desirable or pleasurable effect of the substance per se. Studies have identified misuse as a means that students may adopt to cope with the stressors and demands of the academic environment (Arria & DuPont, 2010) or to alleviate potential stress or negative emotions (e.g., anxiety, despair) associated with inadequate study habits, such as cramming, procrastinating all but for the night before an exam (e.g., DeSantis et al., 2008). In addition, the desire to gain an academic edge over peers is another often-cited instrumental motive for misuse. For example, students who have previously misused prescription stimulants report that they were motivated to use to outperform peers, improve academic performance, stay awake longer, and increase concentration ("Enhancing, Not Cheating," 2007; Johnston et al., 2016; Teter et al., 2005).

Taken together, these findings underscore a potential relationship between common types of stressors and strains and the misuse of prescription stimulants as a means to cope with said strains, consistent with general strain theory (Agnew, 2002, 2009). As such, it is not surprising that a number of recent studies have sought to further examine general strain theory by elucidating the role of strain in stimulant misuse by examining the extent to which negative affective states, such as depression, mediates the relationship between academic-related strain, or academic strain, and NMPSU (Ford & Schroeder, 2009; Maahs et al., 2016; Norman & Ford, 2019; Pate & Bolin, 2018).[3] While the results of these studies have been generally consistent with hypotheses derived from strain theory, they have generally overlooked graduate students. As others have noted, graduate students are frequently under immense stress and academic pressure (Grady et al., 2014), which may increase the likelihood of coping in instrumental ways.

Previous research suggests that graduate students differ in a number of important ways from undergraduates, including with respect to stress and preferred coping mechanisms (Ickes et al., 2015). For example, a recent study by Norman & Ford (2019) finds that, under some conditions, the intent to pursue graduate education among undergraduate students was associated with a greater likelihood of stimulant misuse. The study, however, was limited to undergraduates who reported intentions for graduate school, not graduate students. At the same time, there is evidence to suggest that caffeine consumption and inadequate sleep are potentially more prevalent among graduate compared with undergraduate students (Ickes et al., 2015). As prescription stimulants compliment or offer similar effects, it is possible that graduate students may also be *more* likely to misuse stimulants compared with undergraduate students. Although results such as these are suggestive, the extent to which academic strain processes actually operate in graduate student samples is unclear; thus, further examination remains necessary.

With these considerations in mind, the current study seeks to further the understanding of NMPSU by utilizing self-report data from a sample of undergraduate and graduate students (n = 1,121) attending a Southern urban university. More specifically, our goal is to understand the relationship between academic strain and NMPSU among different college student groups: undergraduate and graduate. It is expected that graduate students will experience negative affective states to a greater degree as a result of academic strain and, therefore, be more likely to report NMPSU compared with undergraduates (Ford & Schroeder, 2009; Norman & Ford, 2018; Prosek et al., 2018). It is important to note that many of the most relevant and informative studies on this topic have employed rudimentary or otherwise flawed measures of academic strain. Therefore, the current study also considers the operationalization of academic strain in the course of this examination.

Nonmedical Prescription Stimulant Use by College Students

Given the social environment and relatively unstructured peer context, experimenting with drugs is not uncommon among college students (O'Malley & Johnston, 2002). Estimates derived over the last two decades suggest that between 5% and 35% of undergraduate students engage in NMPSU in a given year (Arria, O'Grady, et al., 2008; DeSantis et al., 2008; DuPont et al., 2008; Garnier-Dykstra et al., 2012; Low & Gendaszek, 2002; McCabe et al., 2018; McCabe, Teter, & Boyd, 2006; SAMHSA, 2019). Furthermore, a substantial proportion of students who report NMPSU appear to hold false perceptions of stimulants as less risky and recognize fewer negative side effects (e.g., addiction, death) compared with other types of illicit substances (Arria, Caldeira, Vincent, et al., 2008; Johnston et al., 2014) which likely enhance the appeal of these substances as "study aids." The transmission of these false perceptions has been attributed to secondhand information obtained from peers (DeSantis et al., 2008). Consequently, such sociological processes could facilitate widespread dissemination of misinformation throughout college campuses, thus increasing the likelihood of misuse among the growing college populations at both the undergraduate and graduate levels.[4]

NMPSU and Academic Strain

Two general patterns—each related to the frequency of misuse—have been identified among college students. The first, and more common, type is limited misuse or experimentation (represented by curiosity), while the second type has progressed to repetitive or "recreational use" (Arria, Caldeira, O'Grady, et al., 2008; Bossaer et al., 2013; Teter et al., 2005). Despite differences in the frequency, there appears to be considerable overlap in the motivations for misuse. Among the most common motives, students report NMPSU as a means to cope with or preclude the anticipated pressures and stress associated with academic demands (Arria, Caldeira, Vincent, et al., 2008), including

- Enhancing their ability to study and improving concentration (Carroll et al., 2006; Judson & Langdon, 2009; Low & Gendaszek, 2002; Rabiner et al., 2008; Teter et al., 2005),
- Increasing energy, alertness, and length of waking hours for studying (Bossaer et al., 2013; Carroll et al., 2006; Judson & Langdon, 2009; Rabiner et al., 2008; Teter et al., 2005), and
- Improving assignment efficiency and grades (Bossaer et al., 2013; DeSantis & Hane, 2010; Low & Gendaszek, 2002).

In short, instrumental use is not uncommon among college students. Following from these apparent academic-related motives, several studies have demonstrated the applicability of general strain theory (Agnew, 2006) as it relates to NMPSU among college students (Ford & Schroeder, 2009; Maahs et al., 2016; Norman & Ford, 2018; Pate & Bolin, 2018; Prosek et al., 2018). General strain theory is an individualized extension of the macro-level theory developed initially by Merton (1938), which focuses on coping with the disjunction between the desire to achieve goals and a lack of access to the means necessary to do so. In addition to considering short-term and minor types of goals, Agnew (2006) identifies three primary sources of strain: (a) the disjunction between expectations and actual achievements, (b) the removal or threatened removal of valued stimuli, and (c) the presentation or threatened presentation of negative stimuli. Like Merton (1938), Agnew (2006) is careful to specify that criminal behavior is but one means by which one may choose to cope when confronted or threatened by strain.

According to Agnew (2006), criminal coping is most likely to occur when strain leads to or coincides with negative affective states, such as anger, anxiety, fear, or depression. College students potentially experience a variety of strains from myriad sources directly and indirectly

related to academic demands and performance (Pate & Bolin, 2018). Furthermore, these strains have been shown to be related to negative affective states (primarily depression) which, in turn, may increase the risk of substance use in general (Abraham & Fava, 1999; Davis et al., 2008; Zullig & Divin, 2012) and NMPSU specifically (Ford & Schroeder, 2009; Maahs et al., 2016; Pate & Bolin, 2018; Teter et al., 2010). Research attention, however, has yet to be placed on the role of academic strain in NMPSU among graduate students.

Graduate Students, NMPSU, and Academic Strain

A small number of studies have examined NMPSU specifically among graduate students, although many of these have been relatively circumscribed with a focus on graduate students within specific disciplines or programs (e.g., medicine). These studies typically find that between 5% and 15% report NMPSU during their program (De Bruyn et al., 2019; Lord et al., 2009; Tuttle et al., 2010; Webb et al., 2013), while at least one study found as much as 32.3% of their sample reported misuse of a prescription stimulant over the past year (Mineo et al., 2018). Other studies have examined graduate students in comparison to undergraduates in program-specific (Bossaer et al., 2013) and general college samples (White et al., 2006), suggesting that graduate students engage in NMPSU at a similar or a slightly lower rate than undergraduate students.

Although rates of misuse appear similar, the extent to which academic strain and negative affect contribute to misuse among graduate students is less clear, especially relative to undergraduate students (Norman & Ford, 2019). De Bruyn et al. (2019), for example, finds that academic-related stress is an important correlate of NMPSU among Flemish university medical students; however, this finding is not conclusive as stress and strain remain distinct concepts. In short, the extent to which correlates of misuse differed on the basis of graduate status, or whether negative affective states mediated the stress–NMPSU relationship, has been beyond the scope of most studies.

Grounded in the above description of strain theory and motivations for misuse, the role of academic strain in NMPSU is potentially a potent motivator among graduate students despite their near comparable rates of NMPSU. Most notably, graduate students share many of the same responsibilities and expectations as undergraduate students but are under increased pressure as trainees and future contributors to their respective fields (Evans et al., 2018; Smith & Brooks, 2015; Verdi et al., 2016). Direct competition faced by graduate students for limited resources (e.g., mentorship, assistantships) is likely fiercer than that experienced by undergraduates who are less likely to be precluded opportunities as a result of peer success.

Graduate students also tend to have closer, more intimate relationships with mentors which may be an additional source of distress (Evans et al., 2018). While the role of mentoring and close relationships could be viewed as a protective factor, promoting supportive and beneficial relationships (e.g., Tenenbaum et al., 2001), such relationships can also act as a source of stress. For example, graduate students may feel a lot of pressure to live up to mentors' expectations, may not feel valued by their mentors, or have a negative relationship with their mentors which is likely to foster anxiety and depression (Evans et al., 2018). More generally, graduate school tends to be more rigorous, and expectations for performance greater compared with the undergraduate environment (De Bruyn et al., 2019). Thus, academic demands may contribute to a greater degree of negative affective states among graduate students. Along these lines, some have raised concern over a growing "mental health crisis" in graduate education (Evans et al., 2018).

Conversely, graduate students may be better able to cope with academic strain compared with their undergraduate counterparts. The decision to pursue an advanced degree tends to be a calculated decision. Along these lines, Norman & Ford (2019) fail to find a relationship between a categorical measure of academic strain and NMPSU among undergraduate students who aspire to further education after graduation. Students who had difficulty coping during undergraduate

education may be reluctant to pursue further education, suggesting graduate students may be more resilient when faced with strain. In addition, the cohort structure often utilized by graduate programs may offer alternative methods to cope with negative affect induced by strain, such as being able to commiserate with similarly situated peers (Ickes et al., 2015). Furthermore, relatively small cohorts may be more effective in establishing norms, including those related to appropriate coping methods, so it may be more difficult for nonnormative behavior to be tolerated (McIntyre & Platania, 2009; Weidman & Stein, 2003).

Considering developmental and age-graded perspectives, graduate students may be less likely to misuse substances as they are relatively older than undergraduates. Differences in personality and temperament traits may also exist between graduate and undergraduate students (Roberts & Caspi, 2003). Recent research has linked certain temperament traits to an increased likelihood for misuse substances, specifically among graduate students, which may contribute to observable differences in acceptable coping strategies (Mineo et al., 2018). Finally, compared with a bachelor's degree that confers a general set of credentials and knowledge, graduate school can be thought of as an early step in career acquisition; therefore, graduate students may be more risk-adverse to coping with strain and associated negative emotionality through illegal means due to potential consequences to their desired future careers.

Current Study

These considerations notwithstanding, the fact that graduate students use stimulants at a rate similar to undergraduate students deserves further exploration. For the current study, we examine whether the processes that underlie graduate NMPSU is analogous to those of undergraduates. In addition, we seek to understand whether academic strain plays a role consistent with general strain theory. The current study builds upon previous research (e.g., Ford & Schroeder, 2009; Pate & Bolin, 2018) by considering the applicability of general strain theory to NMPSU among graduate students.

The research goals of this study are twofold. First, it seeks to replicate previous results related to academic strain. Similar to these previous studies, negative affect is considered to be the mediating mechanism between academic strain and NMPSU. Second, it examines the extent to which these processes are contingent on graduate status. It is expected that NMPSU will not only be a function of strain process among graduate students, but that these relationships will be of a larger magnitude compared with undergraduates.

It is important to note that general strain theory does not necessarily link *how* individuals cope to the *amount* of strain experienced (e.g., two randomly selected people may report similar amounts of strain yet cope through substantively different means). As such, the current study does *not* hypothesize that graduate students will experience academic strain to a greater or lesser degree compared with undergraduates. Rather, the goal of this study is to determine the applicability of the academic strain framework to each group of students.

Research Methodology

Data and Sample

Self-report data were collected from graduate and undergraduate students attending an urban university in Fall 2015. Statistics from Spring 2016 indicate that minorities and females represent 42% and 60%, respectively, of the approximately 10,700 enrolled students. While precise statistics related to age are not available, the university also has a sizable number of nontraditional students. The survey items of interest to this study were administered online as part of a more general survey on substance use/misuse and overall health/well-being. Email invitations for

Table 1. Descriptive Statistics.

	M	*SD*	Minimum	Maximum
Male	0.322	0.467	0	1
Graduate student	0.293	0.456	0	1
Part-time student	0.291	0.456	0	1
Negative sffect	28.196	7.589	9	52
Stress	3.365	1.229	1	5
School commitment	5.956	0.856	1	7
ADHD	2.407	0.858	1	4.966
Hard drug use	0.137	0.394	0	1
Stimulant misuse	0.087	0.338	0	1
Age	29.543	10.656	16	72
GPA				
A	0.543	0.516	0	1
B	0.390	0.507	0	1
C	0.067	0.261	0	1
Race				
White	0.715	0.452	0	1
Black	0.163	0.370	0	1
Other	0.122	0.328	0	1
Employment				
Full-time	0.383	0.488	0	1
Part-time	0.380	0.487	0	1
Unemployed	0.237	0.427	0	1

Note. ADHD = attention deficit hyperactivity disorder; GPA = grade point average.

survey participation were sent to all students through their university email address. Overall, there were 1,125 student respondents, resulting in a response rate of approximately 10%.[5] Of these, 806 students submitted a complete survey. Because the data are cross-sectional, it was not possible to determine the extent to which nonresponse was contingent upon past or current misuse. However, preliminary analyses indicated that Black respondents were less likely to report NMPSU but more likely to be excluded from the sample if cases were to be deleted list-wise. To avoid potential bias, the data were multiply imputed.[6] In addition, all but four students reported a grade point average (GPA) of at least a "C."[7] Inspection of these cases indicated they were dissimilar to "C" students yet were too few in number to provide reliable estimates. These cases were excluded prior to imputation, resulting in a final sample of 1,121 students. Descriptive statistics for the sample can be found in Table 1.

Dependent Variable: Stimulant Misuse

To measure misuse, respondents were first asked whether they had used prescription stimulants, such as Adderall, Concerta, Dexedrine, or Ritalin, over the past 12 months. Consistent with the definition provided by SAMHSA (2016), misuse is conceptualized as the use of a stimulant for which one does not have a valid prescription or use outside of the manner prescribed. A negative response triggered a skip pattern, and these respondents were not counted as stimulant users. Conversely, an affirmative answer led to respondents being asked whether they have (a) used stimulants prescribed to someone else, or (b) used their own prescription differently than prescribed or for a reason other than why it was prescribed. An affirmative response to either of these secondary items constituted

misuse, while respondents who indicated they had used stimulants with a valid prescription and in the manner prescribed over the same period were not counted as a stimulant misuser.

No one with a valid prescription reported using someone else's stimulants, thus precluding the gray area between use and misuse where one is using someone else's prescription for their own medically prescribed purposes. Based on 1,121 respondents, roughly 98 (8.71%) indicated they had misused over the previous year. This is consistent with previous estimates of stimulant misuse (Carroll et al., 2006; DeSantis et al., 2008; DuPont et al., 2008; McCabe et al., 2005; McCabe, Teter, & Boyd, 2006; Teter et al., 2005). To emphasize, the focus of this analysis is on the misuse of prescription stimulants. Prescription substances are conceptually distinguished from other substances that yield a similar psychopharmacological effect, such as cocaine (all forms). The use of these substances, in addition to other hard drugs, is controlled (described below).

Independent Variables

Academic strain. Academic strain refers specifically to the strain produced by the failure to achieve academic goals (Ford & Schroeder, 2009). Previous studies on NMPSU and academic strain, however, have utilized questionable measurements. For example, Ford & Schroeder (2009) constructed a categorical measure of academic strain by cross-classifying a dichotomized measure of GPA and a single-item indicator of academic importance, creating four distinct groups. While this appears to be consistent with one of the sources of strain described by Agnew (2006), this categorical variable is then utilized in their structural equation models as though it were continuous. Pate and Bolin (2018) used a single item to assess "the amount of stress [respondents] feel as a result of college," which is measured on a 5-point Likert-type scale. While this measure has a similar scale issue as that in Ford & Schroeder (2009), the extent to which it serves as an operationalization of strain as described by Agnew (2002) is less clear.

Similar to Ford & Schroeder (2009), academic strain is operationalized as a function of GPA (actual achievement) and school commitment (adherence to academic goals) in this study. Previous research has utilized GPA as an indicator inversely related to strain (e.g., Agnew & White, 1992; Ford & Schroeder, 2009; Norman & Ford, 2018; Sharp et al., 2001; Vowell & Chen, 2004). A low GPA, however, should not be expected to produce strain in those students who do not value education or school achievement in the first place. Rather, actual achievement is strain-inducing only when they fall short of expectations for success (Agnew, 2002), whereby students who are more committed to academics yet have low GPAs would be more likely to experience academic strain relative to those with similar GPAs but lower commitment.

GPA is measured using a 5-point scale, ranging from an A average to an F average. All but four respondents reported at least a C average. Of the 1,121 respondents, 608 respondents (54.29%) reported an A average, 437 (38.96%) respondents reported a B average, and 76 reported a C average (6.75%).[8] A six-item scale to assess academic commitment was adapted from the Denver Youth Survey and used to measure goals to do well in school and includes items such as "I try hard in school," "Education is so important that it's worth it to put up with things about school that I don't like," and "Grades are very important to me" (e.g., Henry & Huizinga, 2007). Responses are coded on a 7-point Likert-type scale indicating the extent to which the respondent agrees or disagrees with each statement. These six items are then summed and weighted by the number of items to produce the scale in which larger values correspond to more academic commitment. Finally, three interaction terms were created by taking the multiplicative product of academic commitment with indicators of each level of GPA, which allows the relationship between academic commitment and misuse to differ on the basis of actual achievement rather than presuming a constant relationship across varying levels of strain.

Guided by strain theory, and consistent with the previous work of Ford & Schroeder (2009), we do not allow either constituent variable to contribute beyond their joint interaction; the main

effects are thus excluded from model specification.[9] While this method is analogous to specifying three separate models for each of the three observed levels of GPA, it has the benefit of retaining statistical power by utilizing the full sample rather than a subset. Prior to interaction, academic commitment is group-mean centered at each level of GPA to account for differences in baseline commitment at each level of achievement.

Negative affect. The frequency of negative affective states is measured using nine items derived from the Medical Outcomes Study (MOS) 36-item Short Form Health Survey (SF-36) (Ware & Sherbourne, 1992). These measures are identical to those used by Ford & Schroeder (2009) to assess depression. Based on a 6-point frequency scale, respondents were asked how often over the previous 30 days they, for example, "felt full of pep," "felt so down, nothing could cheer them up," "been a happy person" (reverse coded), and "felt worn out." Although strain theory often focuses on anger as the affective state (Agnew, 2002), research indicates that experiences with depression are more likely to be related to substance use (Abraham & Fava, 1999; Davis et al., 2008; Zullig & Divin, 2012). Items were summed to obtain a frequency scale, where larger values correspond to more frequently experiencing negative affective states.

Graduate status. Respondents reported which degree they were presently seeking. Based on the response to this item, an indicator of graduate status was created. Respondents seeking a master's degree, PhD, JD, or graduate certificate were considered graduate students (1), while anyone seeking a BA, BS, or a second undergraduate degree were considered undergraduate students (0). Undergraduates comprise approximately 71% of the sample.

Other Control Variables

Due to the inherent inability to maintain experimental control over the key variables of interest, statistical confounding remains a potential threat. To mitigate the possibility of selection bias, a number of additional variables theoretically or empirically linked to substance misuse are also included in the analysis.

Attention deficit hyperactivity disorder (ADHD). Although holding a legitimate prescription for a stimulant (such as those used to treat ADHD) was considered in the construction of the indicator of stimulant misuse, a complication that should be considered is the possibility of selection bias whereby students are self-treating an undiagnosed condition. While it is debatable whether this should rightly constitute misuse, it is a necessary consideration to determine the role played by academic strain. As such, an 18-item scale based on the adult ADHD Self-Report Scale was administered (ASRS; Adler et al., 2006). There are various scoring mechanisms based on the clinical criteria for ADHD; however, clinical diagnosis is beyond the scope of this analysis. Therefore, we construct this measure by taking the mean of the constituent items, whereby larger values indicate more frequent symptoms.

It should also be noted that while these data also include the Grasmick scale (Grasmick et al., 1993) used to measure the conceptualization of self-control developed by Gottfredson & Hirschi (1990), it demonstrates a relatively strong correlation with the ASRS ($r = \sim.50$). In other words, controlling for both is, to a certain degree, redundant. Given the content area and specific research questions of the current study, we opted to control for ADHD. While each is significantly related to misuse at the bivariate level, only the ASRS remains significant when both are considered jointly.

Stress. Any number of stressors aside from academic strain may induce or promote negative affective states, while numerous other studies have noted the role of high stress in NMPSU (Norman &

Ford, 2019). To account for negative affective states attributable to stressors other than academic strain, an indicator of general stress is controlled. This single item asks respondents "How stressful was your life last semester?" It was measured on a 5-point scale ranging from "not at all stressful" to "extremely stressful," where larger values coincide with greater stress.

Peer deviance. Maahs et al. (2016) find deviant peer associations to be an important correlate of NMPSU, especially compared with academic strain. Therefore, the type of peers with which one associates is assessed using five items. Respondents were asked to indicate how many of their friends engaged in each of the five acts of crime and deviance, including minor theft, attacked someone with a weapon, used marijuana or other hard drugs, sold drugs, and belonged to gang. Responses were summed and weighted by the number of items, where larger values indicate a greater exposure to deviant peers.

Hard drug use. To account for a general propensity to use hard drugs, a variety index was created to assess the number of different drugs used by the respondent over the past year. Included in this index are prescription opiates, tranquilizers, MDMA, cocaine, heroin, hallucinogens, and inhalants. Because alcohol, tobacco, and marijuana tend to be relatively normative in the university context, they were excluded from this index, as were prescription stimulants as it constitutes the dependent variable. The index was then dichotomized to distinguish respondents who have used hard drugs (1 = use), of which 13.70% report doing so, from those who did not report such use (0 = no use).

Enrollment status. Students who attend school on only a part-time basis may experience different amounts of strain than their full-time counterparts. One possibility is that they would experience less strain because they have fewer courses on which to focus. On the other hand, they may experience more strain due to responsibilities in other life domains, such as family or work. Therefore, an indicator is used to distinguish *part-time* (1) from *full-time* (0) students. Overall, 29.07% of respondents reported part-time status.

Employment status. Along the same lines, students who are employed may be more likely to experience academic strain because their efforts and time are divided across multiple domains as they attempt to balance academic life with work. On the other hand, employment represents a tie to conventional activities and institutions and may therefore serve to decrease the likelihood of stimulant misuse. In either case, two dummy variables are created to distinguish respondents who are *unemployed* (23.71%), *employed part-time* (27.99%), or *employed full-time* (38.31%). Part-time employment is treated as the reference category.

Demographics. Controls for age, gender, and race are also included. The average age is 29.54 (SD = 10.786). Males represent 32.20% of the sample, while the majority of respondents are White (71.45%). The next largest racial category is Black (16.32%), while the remainder is distributed between several other racial and ethnic categories (12.22%). As such, two dummy variables corresponding to "Black" and the remaining category "Other" are included in the analysis as demographic controls.[10]

Analytic Strategy

Strain theory primarily posits an indirect relationship between experiences of strain and coping behavior mediated through negative affective states. The current study posits that academic strain promotes the misuse of prescription substances indirectly through its relationship with negative affect. Therefore, this analysis essentially unfolds across three models. The first model

Table 2. Negative Affect and Stimulant Misuse (Full Sample).

	Negative affect		Stimulant misuse			
	Model 1		Model 2		Model 3	
	Coefficient	*SE*	OR	*SE*	OR	*SE*
Academic strain						
A average	−0.665	(0.234)*	0.779	(0.163)	0.782	(0.164)
B average	−0.796	(0.288)*	0.780	(0.204)	0.784	(0.204)
C average	−0.971	(0.410)*	0.925	(0.268)	0.930	(0.269)
Negative affect	—	—	—	—	1.041	(0.021)*
Graduate student	−0.315	(0.456)	1.985	(0.322)*	2.001	(0.322)*
Age	−0.039	(0.021)	0.948	(0.023)*	0.949	(0.023)*
Male	−2.111	(0.447)*	1.511	(0.325)	1.631	(0.330)
Race						
Black	−0.370	(0.568)	0.337	(0.612)	0.330	(0.612)
Other	−1.346	(0.621)*	0.563	(0.519)	0.572	(0.526)
Hard drug use	1.610	(0.698)*	3.354	(0.302)*	3.173	(0.303)*
ADHD	3.207	(0.303)*	1.773	(0.182)*	1.608	(0.194)
Stress	1.465	(0.175)*	1.248	(0.137)	1.183	(0.143)
Part-time student	−0.371	(0.492)	1.125	(0.384)	1.132	(0.384)
Employment						
Unemployed	−0.713	(0.489)	0.673	(0.368)	0.694	(0.371)
Full-time	0.546	(0.512)	0.759	(0.355)	0.739	(0.357)
Peer deviance	0.188	(0.232)	1.412	(0.113)*	1.413	(0.114)*

Note. OR = odds ratio; ADHD = attention deficit hyperactivity disorder.
*$p < .05$.

examines the impact of academic strain on negative affect. Because the distribution of negative affect is relatively normal, linear regression is utilized. In the second and third models, stimulant misuse is the outcome specified. These logistic regression models differ with respect to negative affect but otherwise include an identical set of variables. The second model excludes negative affect to understand the direct relationship between NMPSU and academic strain before negative affect is taken into account in the third model. These three models are first specified upon the full sample. Next, the sample is divided on the basis of graduate status. The models are then re-specified separately for each subsample to determine whether these processes function similarly across graduate status.

Results

Full Sample

Models 1 to 3 displayed in Table 2 show the results based on the full sample of students. Negative affect is the outcome specified in Model 1. Most important, school commitment was found to be significantly related to negative affect for each level of GPA. On average, strong school commitment is associated with less negative affect. However, the lowest achieving students appear to be more sensitive to variations in school commitment compared with higher achieving students (A-students $b = -0.665$; B-students $b = -0.796$; C-students $b = -0.971$). Despite low achievement, strongly committed C-students actually appear more resilient. Along the same lines, weak school commitment appears to be less detrimental for high-achieving students, on average. Based

on the above discussion of strain theory, it was expected that students who cared more about their education—those who are more strongly committed to school—would be the most like to experience negative affect when their actual achievement was low. These results do not support this notion. Rather, weak commitment, especially when combined with low actual achievement, appears to be most strongly associated with negative affect. However, due to the fact these data are cross section, it may be the case that low actual achievement has negatively impacted school commitment. Beyond the impact of academic strain, the ASRS ($b = 3.207$), reports of greater stress ($b = 1.465$), and the use of hard drugs in the past ($b = 1.610$) are also directly related to the negative affective symptoms. Male students ($b = -2.111$) and students of "Other" races ($b = -1.346$) appear to experience less negative affect, on average, compared with females and White students, respectively.

Stimulant misuse is the outcome of Model 2 displayed in Table 2. Recall, this model does not include negative affect to examine the direct relationship between academic strain and NMPSU. Most important, school commitment is unrelated to misuse at any level of GPA. Second, graduate status is associated with a greater likelihood of NMPSU (OR = 1.985), whereby graduate students are almost twice as likely to report NMPSU compared with undergraduate students. At the same time, age is negatively related to the NMPSU (OR = 0.948). A number of control variables are also related to NMPSU. In particular, greater scores on the ASRS (OR = 1.773), peer deviance (OR = 1.412), and previous hard drug use (OR = 3.354) are each associated with a greater likelihood of misuse. Previous hard drug use aside, it should be noted that graduate status is one of the strongest correlates of NMPSU observed in Model 2.

The specification of Model 3 in Table 2 is analogous to Model 2 but with the addition of negative affect. With this addition, two results are apparent. First, students who report more frequent negative affect are more likely to report NMPSU (OR = 1.041). This result, combined with the results from Model 1, suggests that weak school commitment indirectly impacts the likelihood of NMPSU through its relationship with negative affect, especially for those students who are among the lower achievers. By the same token, students who are more strongly committed to school report less negative affect on average, which indirectly suggests that they are less likely to engage in NMPSU. Moreover, the manner in which school commitment varies across actual achievement implies that the odds of NMPSU are diminished to a greater degree for those lowest achieving students relative to the higher achieving students. Second, the addition of negative affect to the model does not substantively alter the relationships between the remaining variables in the model—all remained statistically significant and of a near identical magnitude.

Graduate Student Subsample

The next set of results pertains to the graduate student subsample.[11] Models 4 to 6 are displayed in Table 3. Similar to Model 1 above, negative affect is regressed onto the academic strain variables and other controls in Model 4. Because very few graduate students have a grade lower than a B, those who do are excluded from the analysis, which creates the primary comparison between A and B students. Similar to the models based on the full sample, school commitment is directly related to negative affect among graduate students. Also similar, the relationship is such that stronger commitment is related to less negative affect. However, unlike the previous model, this relationship is not persistent across levels of actual achievement. Rather, school commitment is unrelated to negative affect among those graduate students who have a B average. Among A-students, negative affect is less prevalent among those who are most committed to school and more prevalent among those weakly committed ($b = -0.947$). A number of other factors also appear to be a source of negative affect among graduate students. Specifically, graduate students who are under more stress ($b = 1.493$), score highly on the ASRS ($b = 2.511$), and have previously used hard drugs ($b = 2.438$) report more frequent

Table 3. Negative Affect and Stimulant Misuse (Graduate Students).

	Negative affect		Stimulant misuse			
	Model 4		Model 5		Model 6	
	Coefficient	*SE*	OR	*SE*	OR	*SE*
Academic strain						
A average	−0.947	(0.423)*	0.027	(1.979)	0.812	(0.324)
B average	−1.016	(0.568)	0.778	(0.313)	0.663	(0.436)
Negative affect	—	—	—	—	1.129	(0.052)*
Age	−0.080	(0.036)*	0.962	(0.030)	0.970	(0.034)
Male	−1.932	(0.787)*	1.280	(0.605)	1.659	(0.625)
Race						
Black	0.022	(1.079)	0.519	(1.153)	0.447	(1.212)
Hard drug use	2.438	(1.006)*	5.095	(0.582)*	4.346	(0.606)*
ADHD	2.511	(0.525)*	1.938	(0.330)*	1.493	(0.367)
Stress	1.493	(0.339)*	1.380	(0.273)	1.139	(0.285)
Part-time student	−1.675	(0.825)*	0.939	(0.600)	1.272	(0.645)
Employment						
Unemployed	−0.466	(0.868)	0.634	(0.642)	0.585	(0.686)
Full-time	0.624	(1.213)	0.285	(1.014)	0.212	(1.094)
Peer deviance	0.029	(0.437)	1.579	(0.233)*	1.659	(0.256)*

Note. OR = odds ratio; ADHD = attention deficit hyperactivity disorder.
*$p < .05$.

negative affect. By contrast, students who are attending graduate school on only a part-time basis report less negative affect ($b = -1.675$). Negative affect is also less prevalent among older students ($b = -0.080$) and males ($b = -1.932$).

Found in Table 3, Models 5 and 6 examine the correlates of NMPSU among graduate students.

Most notably, school commitment is unrelated NMPSU among graduate students, which is similar to the full-sample models. Also comparable to the models based on the full sample, graduate students who report higher scores on ASRS (OR = 1.938), associate with a greater number of deviant peers (OR = 1.579), and report previous hard drug use (OR = 5.095) are also more likely to report NMPSU. Negative affect is added to this model to produce Model 6. As can be seen, negative affect accounts for much of the variance previously associated with the ASRS, as the latter is no longer significant. Instead, graduate students who report more frequent negative affect are more likely to report NMPSU (OR = 1.129). Taking these three models together, a pattern similar to the previous set of results emerges. Specifically, weak school commitment appears to indirectly impact the likelihood of NMPSU through its relationship with negative affect. However, this relationship is only apparent among the highest achieving students.

Undergraduate Students

Models 7 to 9 presented in Table 4 are analogous to the previous models but are limited to undergraduate students. Looking at Model 7, a similar pattern emerges. Commitment to school appears inversely related to negative affect. Undergraduate students who are strongly committed to school report less negative affect on average. Examining this relationship across levels of GPA shows a pattern similar to the models based on the full sample. Specifically, the magnitude of the

Table 4. Negative Affect and Stimulant Misuse (Undergraduate Students).

	Negative affect		Stimulant misuse			
	Model 7		Model 8		Model 9	
	Coefficient	*SE*	OR	*SE*	OR	*SE*
Academic strain						
A average	−0.636	(0.286)*	0.725	(0.188)	0.727	(0.189)
B average	−0.817	(0.345)*	0.757	(0.229)	0.763	(0.229)
C average	−1.033	(0.480)*	0.769	(0.319)	0.773	(0.320)
Negative affect	—	—	—	—	1.017	(0.026)
Age	−0.019	(0.027)	0.934	(0.036)	0.933	(0.037)
Male	−2.362	(0.552)*	1.935	(0.397)	2.016	(0.401)
Race						
Black	−0.585	(0.675)	0.224	(0.885)	0.220	(0.886)
Other	−1.266	(0.784)	0.914	(0.550)	0.923	(0.553)
Hard drug use	1.381	(0.899)	2.982	(0.393)*	2.917	(0.396)*
ADHD	3.451	(0.374)*	1.715	(0.234)*	1.639	(0.248)*
Stress	1.422	(0.210)*	1.245	(0.168)	1.215	(0.175)
Part-time student	−0.089	(0.628)	1.114	(0.550)	1.109	(0.551)
Employment						
Unemployed	−0.751	(0.611)	0.788	(0.480)	0.807	(0.485)
Full-time	0.673	(0.594)	0.908	(0.409)	0.897	(0.409)
Peer deviance	0.133	(0.286)	1.441	(0.147)*	1.440	(0.148)*

Note. OR = odds ratio; ADHD = attention deficit hyperactivity disorder.
*$p < .05$.

coefficients appears inversely proportional to actual achievement, such that the association between school commitment and negative affect is more pronounced among low-achieving students compared to high-achieving students (A-students $b = -0.636$; B-students $b = -0.817$; C-students $b = -1.033$). On average, strongly committed students tend to report less negative affect, even at low levels of actual achievement, compared with students who are less committed at equivalent levels of actual achievement. In addition, male undergraduate students report less negative affect than females ($b = -2.362$), while the ASRS ($b = 3.451$) and stress ($b = 1.422$) are associated with greater negative affect.

Models 8 and 9 in Table 4 show the likelihood of NMPSU among undergraduate students before and after controlling for negative affect, respectively. Two important observations are of note. First, similar to the previous models, school commitment is unrelated to NMPSU regardless of actual achievement. Second, and contrary to the previous results, negative affect is unrelated to the prevalence of NMPSU among undergraduate students. More generally, results indicate that undergraduate students who score more highly on the ASRS (OR = 1.639), associate with a greater proportion of deviant peers (OR = 1.440), and report past hard drug use (OR = 2.917) are most likely to report NMPSU. The addition of negative affect leaves the model substantively unchanged with the only difference being that the odds ratio associated with the ASRS reduce in size by a small degree.

Discussion

Academic strain, stemming from Agnew's general strain theory, suggests a meditational process which relates experiences of strain to stimulant misuse via negative affective states. While this

framework has been previously tested and reasonably substantiated (Ford & Schroeder, 2009; Pate & Bolin, 2018), this study sought to expand upon these results in two important ways. The first way was to compare these processes for both graduate and undergraduate students since previous examinations have been typically limited to undergraduate students. In the course of this comparison, the second way involved reconsidering the operationalization of the concept of academic strain. Given the qualitative differences between undergraduate and graduate education (Grady et al., 2014), it was expected that graduate students would be more likely to cope with strain through the misuse of prescription stimulants compared with undergraduate students and that negative affect would play a greater role in this process.

Overall, results were only partially consistent with expectations. While the general pattern of results supports a direct relationship between negative affect and NMPSU, the role of academic strain in this process requires further consideration. Taking a step back, the most applicable sources of strain for the topic at hand arise when one is unable to achieve positively valued goals or when presented with noxious stimuli according to general strain theory (Agnew, 2006). In the context of the current study, it was therefore expected that students who were strongly committed to school, but displayed low actual achievement, would be the most vulnerable to negative affect. This interpretation was also consistent with previous studies of academic strain, including Ford & Schroeder (2009). However, these expectations were seemingly contradicted by the observed results. Although commitment to school was related to negative affect across levels of actual achievement, students who were more strongly committed actually reported less negative affect on average. Thus, it was the students who were weakly committed and displayed low actual achievement that were most vulnerable to negative affect.

In addition to the relationship with negative affect not appearing as expected, it should also be noted that the direct effect of academic strain was found to be unrelated to the likelihood of NMPSU. While the lack of a direct relationship between academic strain and misuse might seem detrimental to the current study and strain theory more generally, it is a common misconception that a direct effect is required for mediation to exist (MacKinnon et al., 2007). In fact, a contemporary statistical understanding of mediation has no such requirement (Kenny, 2018). Accordingly, the results found here are consistent with what Zhao et al. (2010) term "indirect-only" mediation, which is similar to and consistent with the idea of full mediation described by Baron & Kenny (1986). In short, our results suggest the impact of academic strain to be entirely indirect through its relationship with negative affect. Notably, this result is substantively consistent with Ford and Schroder (2009) who also find an entirely indirect relationship between academic strain and NMPSU. This result is also consistent with general strain theory, which posits that the impact of various stressors and strains on behavior depends upon the degree to which they produce negative emotionality that one is unable to cope with through other, more positive means (Agnew, 2006).

Results from the full-sample models indicate that graduate students are twice as likely to report NMPSU compared with undergraduate students. To further explore potential differences in the academic strain framework, the sample was partitioned on the basis of graduate status and models were re-estimated separately for each subsample. A pattern of results similar to those of the full sample was observed with respect to graduate students. Furthermore, compared with the full model, the impact of negative affect on NMPSU is more substantial when limited to graduate students (i.e., the odds ratio is three times as large among graduate students; a 4% increase in odds versus a 12% increase in odds for a unit change in negative affect). By contrast, the results from models limited to undergraduate students were less favorable. While weak school commitment was a source of negative affect across all levels of GPA, no role for negative affect was identified with respect to NMPSU. Although this result is consistent with a recent study by Norman & Ford (2019) who fail to find a relationship between academic strain and NMPSU in a

sample of undergraduate students, further research is required before it can be concluded that academic strain does not apply to undergraduate students.

How do these results bear on the role of academic strain? First, it goes without saying that the results from a single study should be considered tentative. With this in mind, these results appear largely consistent with strain theory in general and the ideas of academic strain in particular, especially with respect to graduate students. Early evaluations of general strain theory appeared to show that educational strains were unrelated to crime (Agnew, 2009). However, these results, along with similar studies (e.g., Peck et al., 2018), underscore the importance of identifying outcomes that represent reasonable means of coping with respect to the specific strains under examination. Using substances thought to enhance the ability to study to cope with the stressors associated with an academic environment is consistent with expectations concerning instrumental motives for use (Arria & DuPont, 2010; Barrett et al., 2005; DuPont et al., 2008).

More generally, future studies should further consider the conceptualization of academic strain including its antecedents. Consistent with Ford & Schroeder (2009), we hypothesized that academic strain would be most likely to produce negative affect and, in turn, increase the likelihood of substance misuse among those students who are most committed to school but fall short in terms of actual achievement. Our results clearly run counter to this line of reasoning. One possible explanation for this seeming inconsistency is that the actual source of educational strain has been misunderstood. While grades are certainly relevant, they are of secondary importance when compared with graduating or credentialing. In other words, students who view their education as a tolerated obstacle toward a rewarding career rather than an achievement unto itself may experience greater negative affect and be more likely to cope via NMPSU to graduate at any cost. This view is potentially more common among minority students, nontraditional students, and graduate students. Likewise, the relationship between gender and negative affect showed that males had reduced levels of negative affect, which may be due to increased confidence levels and willingness to take risks (e.g., Cipriani, 2018; Croson & Gneezy, 2009). In addition, both minority and male students have been found to utilize different coping skills compared with White and female students (e.g., Ickes et al., 2015), which may explain their lower levels of negative affect.

Along the same lines, students who are less committed to school may be less likely to care about their grades in the first place and, therefore, experience less negative affect from low achievement. At the same time, high-achieving students may be under increased pressure to succeed, perhaps due to the same view of college as the career gatekeeper, and experience greater strain as a result, especially if they are less committed to school in the first place. Unfortunately, it is necessary for future research to attempt to disentangle these possible time-ordered interpretations given the cross-sectional nature of these data.

In addition to the conceptualization, the operationalization of academic strain also deserves further consideration. In general, strain theory has been hindered by difficulties associated with identifying meaningful operationalizations of core concepts (Agnew, 2009)—even this study borrowed and adapted a measure more often seen in studies on control theory to assess commitment to educational goals. Consequently, academic strain has been operationalized in a number of disparate ways, yielding equally disparate and inconsistent results. To address these inconsistencies, future research should take care when selecting measures of academic strain from the existing literature. While our revised approach to the operationalization of academic strain appears promising, it is also important to consider other studies of academic strain and stimulant misuse in context.

Ford & Schroeder's (2009) study, for example, is notable as one of the first studies to examine the academic strain, negative affect, and stimulant misuse nexus. Although their results were generally supportive of this perspective, they should be interpreted with a degree of caution due to the fact that their model linking academic strain to negative affect included only a minimal set of demographic variables and controls for past substance use. By contrast, the current study

utilized a stringent set of control variables to isolate the independent contribution of academic strain, including measures of past hard drug use, peer use, general stress to complement academic strain, and an assessment of a relatively common condition known to promote stimulant misuse specifically in the process of self-treatment (i.e., ADHD). While it is not possible to determine how their results would change with the addition of further controls, it is possible to create an identical measure of academic strain in the present analysis. Based on the question "how important is academic work?" and following an identical procedure, creating and using a 4-point categorical variable to model negative affect in addition to controls for age, gender, race/ethnicity, and previous hard drug use (see Ford & Schroeder, 2009, p. 34, for details). Results (not shown) replicate those of Ford & Schroeder (2009), whereby academic strain is directly related to severity of negative affect ($b = 0.811$). However, this relationship falls to nonsignificance when a more robust set of control variables is introduced.

In study similar to the current study, Pate & Bolin (2018) did not find a relationship (indirect or otherwise) between academic-associated stress and stimulant misuse. However, their study appears to diverge from the extant literature in a number of important ways. In addition to the fact that their measure of academic strain is far more general than the one utilized here or by Ford & Schroeder (2009), they fail to find a relationship between one of the relatively more consistent relationships found in the literature, namely differences in the prevalence of negative affect across sex (Evans et al., 2018; Nolen-Hoeksema, 2001). Moreover, neither depression nor their measures of stress were found to be associated with stimulant use. The only variables that were found to be related to stimulant use were the "White" race/ethnicity indicator, marijuana use, hard drug use, and friend misuse of over-the-counter medications. In short, their primary findings with respect to stimulant use might be best summarized as "poly-drug users also use stimulants"—a finding which has been noted elsewhere (Arria & DuPont, 2010), but fails to support strain theory.

Taken together, the results of the present study represent some of the strongest support thus far for the academic strain framework. With this in mind, future studies can build upon this study's design and results in a number of productive ways. First, the university from which the current study's data were drawn may not be comparable to other institutions as it is an urban campus with a sizable minority population and a fair number of nontraditional students, so studies based on other academic samples would be appropriate. For example, evidence suggests that relatively more affluent students are not only more likely to use illicit substance, but also use substances to cope with stress (Martin, 2019). As such, future research engaged in extending the academic strain framework to other college samples will likely benefit from considering colleges that vary on the average level of affluence.

In addition, the low response rate likely impacts the ability to generalize these results beyond the current sample. Moreover, the present sample skewed somewhat toward female and White with respect to the population of the university it was drawn from. Therefore, these results may not generalize to other academic institutions or populations that are less likely to experience negative affect resultant from academic strain. Future studies should attempt to implement random or stratified random sampling on dimensions of interest when possible since academic aspirations, cultural definitions of academic "success," and the ways in which minority and older student populations cope with strain may be dissimilar to predominately White and younger student populations (Griffith et al., 2017; Neblett et al., 2006; Osborne, 1997; Peck et al., 2018).

Second, low- and under-achieving students composed a small proportion of the sample. It is not clear to what extent their proportion coincides with that of the university as a whole, but it was potentially an underestimate. Underperforming students may naturally select out if they perform poorly for long enough, so it is possible we have failed to capture the full distribution of academic strain. This is a notable limitation as low academic achievement appears to correlate with the likelihood of NMPSU (Arria & DuPont, 2010). While obtaining greater representation

of all levels of academic performance is an important goal necessary to explore general strain processes more fully, it will likely require the ability to sample directly on the basis of academic achievement, which may be difficult to accomplish given restrictions around student grades. With further respect to selection processes, some students may be more or less resilient to negative affective states and more likely to cope in maladaptive ways on the basis of temperament (Leite et al., 2014; Mineo et al., 2018). The ability to consider temperament and subjective response to objective experiences of strain, such as academic failure, in future studies could represent a considerable advancement in this line of research.

Finally, as noted above, the cross-sectional nature of the data collected makes it difficult to disentangle the relationship between grades, commitment, strain, and subsequent processes. This is problematic to the extent that hard drug use, including stimulant misuse, contributes to negative affect, poor grades, and weak academic commitment (Arria et al., 2013; Brook et al., 2002; Teter et al., 2010; Zullig & Divin, 2012). Future studies could potentially disentangle these issues by considering students at multiple points throughout the semester or across the academic year. Along the same lines, the 30-day reference period utilized to measure negative affect also limits the ability to establish temporal ordering to a certain degree. Although this measure has been previous validated (McHorney et al., 1993) and used by Ford and Schroder (2009), future research could benefit by utilizing additional measures of negative affect, including clinical measures, or by taking multiple measurements across the study period. Despite the fact that previous hard drug use was controlled in an attempt to limit the impact of selection bias and isolate the roles of academic strain and negative affect, longitudinal data would substantially contribute to this line of inquiry.

That said, to a certain degree, it does not matter whether it is the students who are the most or least committed to school that are relatively more vulnerable to negative affect—the impact of stress and strain in this process is apparent. Requisite replication notwithstanding, these results demonstrate the need for targeted and effective stress management on college campuses (Arria & DuPont, 2010), especially among those students who might seem least likely to need it at first blush—namely students who are high achieving or in graduate programs. Institutions may be better able to intervene to help their students if they are aware of and understand the institutional forces that correlate with misuse (Arria & DuPont, 2010).

In addition, the strong correlation between stimulant misuse and ADHD symptoms in conjunction with the number of students scoring highly on the ASRS is concerning. Stimulant misuse may be primarily driven by undiagnosed students who are self-treating (i.e., coping in theoretical strain terms) with a condition detrimental to their short- and long-term goals. Further research should consider the costs and benefits of early screening for this and similar conditions. On the one hand, early screening could potentially reduce harms associated with self-treatment, reduce other negative correlates of an undiagnosed condition, and improve academic outcomes. Conversely, overdiagnosing is also a potential concern, so this risk must be appropriately balanced. These results highlight the importance of considering negative-affect-inducing strains in the identification of stimulant misuse. Although the role of academic strain requires further and more extensive research, these results offer important implications for research and for the treatment and prevention NMPSU on college campuses.

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Notes

1. Specifically, a greater percentage of college students (10.7%) reported having used Adderall in the past year in comparison to their noncollege peers (8.9%), young adults (7.7%), high school seniors (7.5%), and noncollege respondents in general (7.1%) in a 2015 national sample (Johnston et al., 2016). This has been the trend beyond 2015 for 2010 to 2015 (Johnston et al., 2016).
2. Ritalin use has continued to decline (2001–2014), but the increased prevalence of Adderall may be a contributing factor (Johnston et al., 2016).
3. Prior to Pate and Brolin (2018), various results of our current study were presented at the American Society of Criminology (Hurst et al., 2016a) and the Academy of Criminal Justice Sciences (Hurst et al., 2016b) annual conferences.
4. From 2004 to 2014, the total college enrollment increase was 10% greater than the traditional college-age population (17% and 7%, respectively), and the number of degrees conferred across all undergraduate and graduate levels also rose (National Center for Education Statistics, 2016).
5. Unfortunately, it was not possible to obtain a random sample of students given the larger purpose of the survey. However, as described below, the reported prevalence of stimulant misuse is consistent with other prevalence estimates.
6. Data were multiply imputed via chained equations in R using the *mice* package (Van Buuren & Groothuis-Oudshoorn, 2011). Altogether, 50 multiply imputed data sets were created. Algorithmic convergence was inspected and distributions of all variables were examined to verify the appropriateness of imputed values. All estimates were obtained in accordance with Rubin's (2004) rules.
7. These four students indicated that their GPA was currently in the range of a "D." While it cannot be determined with certainty, the small number of "D" respondents is likely attributable to the fact those students drop out or are otherwise prevented from continuing.
8. Four respondents reported a D average. These cases were excluded as there were too few to obtain meaningful estimates.
9. Supplemental analyses examine a fully cross-classified model, including both the main and interaction effects. Results are substantially the same when it comes to the interaction, while neither main effect is significantly related to misuse.
10. Official university estimates of the undergraduate population indicate that it is approximately 60% female, while the two largest racial categories are White (58%) and Black (22%). The sample of undergraduates report here skews more greatly toward White (70%) and female (69%). Official estimates of age are reported based on the proportions of undergraduate students that fall into particular intervals. The sample reported here tracks closely with the official distribution of age. Official demographic information for graduate students is unfortunately unavailable.
11. It should be noted that there were too few graduate students to support the category of "other" races/ethnicities. Therefore, Models 4 to 6 only include a single indicator to distinguish Black graduate students from everyone else.

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