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A mixed-methods approach examining illicit prescription stimulant use: Findings from a northern California university

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Abstract

Preventing the illicit use of prescription stimulants, a particularly high-risk form of substance use, requires approaches that utilize theory-guided research. We examined this behavior within the context of a random sample of 554 undergraduate students attending a university in northern California. Approximately 17% of students self-reported engaging in this behavior during college; frequency of misuse per academic term ranged from less than once to 40 or more times. Although most misusers reported oral ingestion, a small proportion reported snorting and smoking the drug. The majority of misusers reported receiving the drug at no cost, and the primary source of the drug was friends. Misusers were motivated by both academic (e.g., to improve focus) and non-academic (e.g., to experiment) reasons. Our thematic analyses of an open-end question revealed that students abstaining from illicit use of prescription stimulants did so primarily for reasons related to health risks, ethics, and adherence regulations. Results from adjusted logistic regression analyses showed that correlates of the behavior were intrapersonal, interpersonal, and environmental in nature. We conclude that characteristics of misuse are a cause for concern, and correlates of the behavior are multifaceted. These findings, in addition to insights provided by students who choose not to engage in this behavior, suggest that a number of prevention approaches are plausible, such as a social norms campaign that simultaneously corrects exaggerated beliefs about prevalence while also illustrating why abstainers, in their own words, choose to abstain.

Keywords

College students; Illicit use of prescription stimulants; Etiology; Prevention

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Conflict of Interest

We have no conflict of interest to report.

Introduction

The illicit use of prescription stimulants [IUPS] is a potentially addictive behavior that has grown in prevalence on college campuses. Among the U.S. population aged 12 or older, past-month nonmedical use of prescription stimulants, which represents one form of IUPS (Bavarian, Flay, Ketcham & Smit, 2015), was estimated as 0.6% in 2014; prevalence was found to be highest in the sub-population aged 18 to 25 (i.e., 1.2%; Center for Behavioral Health Statistics and Quality, 2015). A multitude of college-based studies report higher prevalence estimates. For example, in the four-year assessment of one college cohort, 13.3% of students engaged in nonmedical use of these drugs in year 1 of the study, and 31% did so by year 4 (Garnier-Dykstra, Caldeira, Vincent, O'Grady, & Arria, 2012). In a separate study, trend analyses from one university showed a significant increase in lifetime IUPS between 2003 (8.1%) and 2013 (12.7%; McCabe, West, Teter, & Boyd, 2014). Given the health risks associated with these drugs, such as cardiomyopathy, myocardial infarction and psychosis (Lakhan & Kirchgessner, 2012), it is not surprising that there was a significant increase in the number of emergency department visits by college-aged youth related to the use of prescription stimulants between 2005 (1,310 visits) and 2010 (5,766 visits; Substance Abuse and Mental Health Services Administration, 2013).

Research on IUPS has grown substantially in the past decade. A large number of studies have examined demographic correlates of IUPS, revealing that males (Emanuel et al., 2013; Hall, Irwin, Bowman, Frankenberger, & Jewett, 2005), students identifying as White (DeSantis, Webb, & Noar, 2008; DuPont, Coleman, Bucher, & Wilford, 2008), and upperclassmen (Babcock & Byrne, 2000; DeSantis et al., 2008) are more likely to engage in the behavior. An increasing number of studies have examined personality-based correlates, showing associations of IUPS with inattention and hyperactivity (Arria, Garnier-Dykstra, Caldeira, Vincent, O'Grady, & Wish, 2011; Rabiner, Anastopoulous, Costello, Hoyle, & Swartzwelder, 2010) and sensation seeking (Hartung et al., 2013; Weyandt et al., 2009). Social groups specific to the college experience, such as fraternities (DeSantis et al., 2008; McCabe, Knight, Teter, & Wechsler, 2005), have also shown a greater likelihood of engaging in IUPS.

Although these studies have advanced our understanding of IUPS, several research gaps remain. One gap pertains to the narrow definitions that have been used to define IUPS. For example, although classes of prescription stimulants include methylphenidate, dextroamphetamine, and amphetamine, some studies have inquired solely about methylphenidate misuse (e.g., Babcock & Byrne, 2000). Additionally, some studies have examined only non-prescribed use of prescription stimulants (e.g., Advokat, Guidry, & Martino, 2008) although students with a prescription for medical stimulants are also a high-risk group for IUPS (e.g., Tuttle, Scheurich, & Ranseen, 2010). These narrow definitions may lead to an underestimation of the prevalence of IUPS and affect findings related to characteristics and correlates of use. Another gap pertains to the limited number of studies (e.g., McCabe et al., 2005) that have examined broader environmental correlates of IUPS. Lastly, although multi-campus studies (e.g., McCabe et al., 2005) have found the majority of students at participating campuses do not engage in IUPS, we are aware of no studies that

have examined why this is the case. Increased understanding of motives for abstention could guide prevention efforts.

To address these gaps, we replicated a previous study completed at one Pacific Northwest university (Bavarian, Flay, Ketcham, & Smit, 2013b) at a new location, and with an updated version of a previously validated instrument (Bavarian, Flay, Ketcham, & Smit, 2013a). Specifically, we drew a probability sample of students attending one northern California university who completed the Behaviors, Expectancies, Attitudes, and College Health Questionnaire [BEACH-Q], an instrument that comprehensively defines IUPS (Bavarian et al., 2013a). Our aims were to assess the 1) prevalence; 2) characteristics; and 3) intrapersonal, interpersonal, and ecological correlates of IUPS; and to 4) investigate why students abstain from the behavior.

Methods

Study Design

As previously reported (Bavarian et al., 2014), we used one-stage cluster sampling to obtain the survey sample. We recruited a simple random sample of all undergraduate classes at a California public university offered during the spring 2013 academic term that met inclusion criteria (e.g., lecture-based academic courses with an instructor's name on record). We sent e-mails to instructors of 150 randomly selected classes requesting permission to have their class participate in the study. Paper-based versions of the updated BEACH-Q were completed by students. Eligible students (any undergraduate student over 18 years of age) attending class on the day of survey administration who chose to participate in the voluntary and anonymous survey received a \$5.00 gift certificate to a campus vendor. Study methods were approved by the Institutional Review Boards of the university and the Pacific Institute for Research and Evaluation.

Participants

Of the 150 instructors we contacted, 34 permitted entry into the one classroom that had been randomly selected, and limited resources allowed us to survey 24 classes. A total of 554 undergraduate students from the 24 classrooms participated (student response rate = 90.5%). The sample consisted of 58% female students; students identified as 34% White, 32% Asian/Pacific Islander, 19% Hispanic, 4% South Asian, 3% Black Non-Hispanic, and 8% Other. The breakdown by year was 15.9% 1st year, 11.7% 2nd year, 25.3% 3rd year, 40.8% 4th year, 5.6% 5th year or more, and <1.0% other. The student sample was representative (i.e., similar with respect to distribution by gender, race/ethnicity, and age) of the total undergraduate population at the university under investigation.

Measures

Defining IUPS—We created the dependent variable, college IUPS, using student responses to three items. We asked students if, during college, they had ever used prescription stimulants (1) without a prescription from a health care provider; (2) for nonmedical purposes (i.e., to help with studying, to stay awake, to get high); or (3) in excess of what was prescribed. In order to have a measure of IUPS that encompasses the various forms of

misuse, we classified a student as an illicit user if he or she engaged in any or all of these behaviors. For example, a student who replied “yes” to the first behavior but not the second two behaviors was classified as engaging IUPS, as was a student who said “yes” to engaging in the second two behaviors but not the first.

Characteristics of IUPS—Students reporting IUPS completed a set of questions on frequency of misuse (never to 40 or more occasions per academic term), initiation period (elementary school to college), routes of ingestion (e.g., oral, intranasal), cost per pill (*No charge* to *More than \$10*), source of drug (e.g., self, friend), and motive for use (e.g., improve focus, party longer). For these items, we instructed students to check all that were true for them. Students also indicated how often (*none of the time* to *all of the time*) their behavior produced the outcome they desired.

Reasons for Abstaining—We asked all students three questions reflecting their attitude towards engaging in the three different forms of IUPS, with response options ranging from *strongly disagree* to *strongly agree*. As a follow-up open-ended question, we asked, “If you said ‘Strongly Disagree’ or ‘Disagree’ [that it is OK to engage in these behaviors] ... why do you feel this way?”

Behavioral Correlates—The behavioral correlates included in the updated BEACH-Q are intrapersonal, interpersonal, and environmental in nature, and have previously demonstrated an association with IUPS (Bavarian et al., 2013a). The items encompass the theoretical framework proposed by the Theory of Triadic Influence (TTI; Flay et al., 2009; Flay & Petraitis, 1994), an ecological meta-theory. The TTI classifies independent variables by streams of influence (i.e., intrapersonal, social situation/context, and sociocultural environment) and levels of causation (i.e., ultimate, distal, proximal, and immediate precursor). Figure 1 presents an adapted version of the theory, and Figure 2 shows the variables we used in our analyses.

As shown in Figures 1 and 2, intrapersonal variables represent characteristics of one’s biology, personality, and demography that influence one’s behavioral self-efficacy. Our intrapersonal variables included: inattention, hyperactivity, sensation-seeking, gender, race/ethnicity, age, year in school, international student status, study habits, psychological distress, ADHD diagnosis, academic concern, academic grades, and avoidance self-efficacy.

The social situation/context stream represents characteristics of one’s social setting that affect social normative beliefs towards a behavior. Variables we used in this stream included: Residence, Greek Life, Varsity Sports, Perceptions of IUPS by Socializing Agents, Endorsement of IUPS by Socializing Agents, Motivation to Comply, and Behavioral Norms.

The sociocultural environment stream of influence represents characteristics of one’s broader environment that influences attitudes towards a behavior (Flay et al., 2009; Flay & Petraitis, 1994). Our sociocultural environment variables included: Financial Stress, Diversion (a new addition from the previous BEACH-Q), Participation in Religious Activities, Media Exposure, Perceived Academic Demand, Perceived Substance Use

Culture, Perceived Practices of Health Care Providers, Interactions with Social Institutions, IUPS Expectancies, and Attitudes towards IUPS.

As shown in Figures 1 and 2, ultimate-level variables are furthest removed from the behavior of interest and influence distal-level variables; distal-level variables are affective and behavior-related variables that influence proximal-level variables; proximal variables represent the individual's perceptions of attitudes, norms, and self-efficacy, and these variables are the immediate predictors of behavioral intention (a variable in our analyses), which is the immediate precursor of behavior, which, in our analyses, was IUPS (Flay et al., 2009; Flay & Petraitis, 1994).

Data Analysis

We first calculated descriptive statistics for responses related to prevalence of IUPS during college, frequency of misuse, and characteristics of the behavior. For the analyses examining reasons for abstention from IUPS, we analyzed eligible responses from the open-ended question inductively using a thematic analysis procedure (Miles & Huberman, 1994). Two of the authors independently read the responses to the question before identifying and agreeing on themes that emerged as patterns. After we identified initial themes, we coded each response and, as a result, an additional theme emerged. We coded data according to the agreed themes and an independent reader verified that each response was coded within the appropriate theme. Where we identified discrepant cases, the two authors and the independent reader came to an agreement for each response. We calculated frequencies for responses encompassing one of the themes, multiple themes, and "other" themes (i.e., responses not falling within the agreed upon classification system).

Our preliminary crude logistic regression showed that of the 39 constructs included, 23 had significant associations with IUPS in the expected directions; these results (not shown) speak to the construct validity of the updated BEACH-Q. As we aimed to assess correlates of IUPS within each of the TTI's three streams of influence, rather than test the most parsimonious model, we estimated three separate logistic regression models (i.e., one for each stream of influence). We estimated these models in a nested (i.e., block-wise) manner using Stata's "nestreg:logit" option (Long & Freese, 2006). We added ultimate-level variables, then distal-level, then proximal-level, then the immediate precursor (i.e., four blocks total) to each model. We employed this approach due to the proposed flow of the TTI. We examined the contribution of each block of variables to determine if each set of variables significantly contributed to the model. Stata's "nestreg" command removes observations with missing values from model estimation; that is, students were included in a particular model only if they had responses for each item in the model. We did not adjust models for clustering, as the Median Odds Ratio (*MOR*; Merlo et al., 2006) indicated little variation in IUPS between classrooms (i.e., *MOR* = 1.63). Lastly, although the Pseudo- R^2 provided by Stata in logistic regression models (i.e., McFadden's R^2) does not have an identical interpretation to the R^2 provided in linear regression models, we examined changes in Pseudo- R^2 across blocks to assess if the ability to predict IUPS improved across models within each stream; we also compared the log likelihood across nested models to determine improvements in the model (Institute for Digital Research and Education, 2011).

Results

Prevalence and Characteristics of IUPS

Approximately 17% of students ($n=92$) reported engaging in IUPS during college. Of these, 89 reported misusing the drug for nonmedical purposes, 77 students reported taking the medication without a prescription, and 32 reported taking the medication in excess of what they had been prescribed. Approximately 75% of misusers initiated the behavior during college (Table 1). Frequency of misuse per academic term ranged from less than once to 40 or more times. Although most users reported oral ingestion, routes including snorting, smoking, and injecting were all reported. Moreover, two students reporting “other” routes reported anal administration of the drug. The majority of users reported receiving the drug at no cost (78.1%), from friends (93.6%), and engaging in misuse for academic-related reasons such as to improve focus and concentration (78.8% each). These academic motives notwithstanding, relatively large percentages of misusers reported engaging in misuse to experiment (47.2%) and party longer (34.7%).

Reasons for Abstaining

Our thematic analysis of 303 eligible responses (i.e., abstainers who had a negative attitude towards IUPS) yielded three major themes: Health Hazard, Ethical Concern, and Adherence. We coded responses as matching the Health Hazard category (47.2%) if there was reference to IUPS being unhealthy, dangerous or an addictive behavior (“It’s not safe. There can be negative health effects”). We included responses as Ethical Concern (20.1%) if they related to legality, issues of academic integrity or autonomy (personal choice). Example responses within this theme include, “It’s not fair for the other students who are busting their butts off w/out Rx help,” and “It’s illegal.” We coded participant responses that referenced needing to follow dosage recommendations as Adherence (7.9%); these include responses such as, “You get a certain medication/dosage for a reason. Stick with it.” Additionally, we coded 14.9% of responses as Multiple when they included elements of more than one of the major themes (“Dangerous to health; unfair advantage-in essence the equivalent to steroid use in sports”). Lastly, we coded a response as Other (9.9%) if a response did not include enough information to determine meaning or if the response did not make sense relative to the question posed (e.g., “Signs of a broken education system that isn’t engaging students in a healthy way”).

Theory-Based Correlates of IUPS: The Intrapersonal Stream of Influence

We present results from the intrapersonal stream in Table 2. In the ultimate-level-only model of the intrapersonal stream (Table 2, Model 1), four covariates were significantly associated with IUPS (inattention, sensation-seeking, ethnicity, and year in school). After including distal-level variables (Table 2, Model 2), each of the four ultimate-level variables remained significantly associated with IUPS, and grades had a significant association with IUPS. Table 2, Model 3 shows avoidance self-efficacy was inversely associated with IUPS, as was inattention, sensation-seeking, race/ethnicity, and year in school.

Table 2, Model 4 represents the full model for the intrapersonal stream of influence. Each block of variables significantly contributed to the final model, and the Pseudo- R^2 increased

from 25.3% (Table 2, Model 1) to 59.7% (Table 2, Model 4). The improvements in log likelihood across models also suggested improved fit across the nested models. For every unit increase in inattention, there was a significant increase in the odds of IUPS. Similarly, for every unit increase in sensation-seeking, odds of IUPS increased significantly. Asian students were 69% less likely to engage in IUPS than students identifying as White, and 2nd, 4th, and 5th year or more students were all more likely to engage in IUPS than 1st year students. Students earning a B grade average were 60% less likely to engage in IUPS than students with an A average. Lastly, we found IUPS intentions to be a strong and significant correlate of actual IUPS.

Theory-Based Correlates of IUPS: The Social Situation/Context Stream of Influence

Table 3 presents results for the nested logistic regression for the social situation/context stream of influence. Table 3, Model 1 shows residence and IUPS were associated. After adding distal predisposing influences (Table 3, Model 2), residence remained significant, and four additional variables had an association with IUPS (Greek Life, Varsity Sports, Perceptions, and Endorsement). In Model 3, residence, perception, and endorsement maintained significant associations with IUPS behavior, and perceived use by friends was associated with IUPS.

Table 3, Model 4 represents the full model for the social stream. Each block of variables significantly contributed to the final model, and the Pseudo-R² increased from 1.3% (Model 1) to 52.7%. The improvements in log likelihood also suggested improved fit across the nested models. In the full model, students living off-campus were significantly more likely to engage in IUPS, than students living in other housing arrangements. With respect to social groups, varsity athletes were more likely to engage in IUPS than non-athletes. For every unit increase in friends endorsement of IUPS, there was a 1.7 increase in the odds of the student engaging in IUPS. IUPS intention was directly and strongly associated with IUPS.

Theory-Based Correlates of IUPS: The Sociocultural Environment Stream of Influence

The ultimate-only model for the sociocultural environment stream (Table 4, Model 1, Pseudo-R² = 30.4%; log likelihood = -168.36) included nine covariates, of which two, perceived drug culture and diversion, were significantly associated with IUPS. The variables from Model 1 remained significant after inclusion of the distal predisposing variables (Table 4, Model 2). Moreover, in this model, IUPS expectancies were significantly associated with IUPS. In Model 3, diversion and expectancies remained significant predictors of IUPS, and attitudes became significant. In the full model (Table 4, Model 4, Pseudo-R² = 42.3%; log likelihood = -115.43), diversion and intentions were the only variables significantly associated with IUPS. For every unit increase in IUPS intentions, the odds of engaging in IUPS increased significantly. Again, each block of variables significantly contributed to the final model.

Discussion

Approximately one in five college students in our study engaged in IUPS. Classifying the behavior more comprehensively demonstrated that even students with a prescription for these medications are engaging in IUPS. For example, 32 students reporting IUPS used the

drug in excess of what had been prescribed. Moreover, friends (presumably with a prescription for these drugs) were the primary source of diversion, and diversion was a significant predictor of IUPS in our logistic nested regression analyses. These findings suggest that students with a prescription for these medications should be closely monitored for illicit use and receive consultation regarding the health and legal consequences of diversion.

Responses to questions directed towards illicit users suggest that college is an ideal setting for prevention and intervention efforts. Specifically, 75% of misusers reported initiating this potentially addictive behavior during college. Prevention and intervention efforts in this sample are particularly warranted. Attention should be focused on the small proportion of misusers who reported administering the drug in a manner other than intended (e.g., smoking, injecting, anal ingestion); this finding is particularly worrisome as these behaviors increase the abuse potential of these already addictive medications (Volkow & Swanson, 2003).

A large majority of students (83%) refrained from IUPS altogether; this finding is similar to the 75% IUPS abstention reported in our study completed at one campus in the Pacific Northwest (Bavarian et al., 2013b). The results also parallel results from our secondary analysis of data from 18 campuses, which looked specifically at non-prescribed use. In that analysis, we reported an abstention range of approximately 80% to 99% (Bavarian, Flay, & Smit, 2014). Our previous findings, in combination with our finding from this study, could be particularly helpful in developing social norms campaigns that correct exaggerated beliefs concerning the prevalence of IUPS. Moreover, our study supplements this statistic with qualitative data from 303 students who abstained from IUPS and had negative attitudes towards IUPS. To our knowledge, our study is one of the first to ask students who abstain from IUPS to elaborate on their reasons for doing so. The various reasons provided by students can bolster social norms campaigns aiming to prevent behavior initiation. It should be noted, however, that messages created based on these qualitative data may resonate most strongly with similar students (i.e., students who do not engage in IUPS and who have negative attitudes towards the behavior).

The findings from our nested logistic regression analyses compare and contrast with our past research. As we have reported in a previous study conducted at a Pacific Northwest university (e.g., Bavarian et al., 2013b), inattention and sensation-seeking were associated with IUPS across models. As such, students exhibiting signs of inattention or sensation-seeking should be monitored closely. One finding from the intrapersonal stream that contradicts previous research is that students at this particular campus with a B grade point average were *less* likely to engage in IUPS than those with an A average. Characteristics unique to this particular campus should be further investigated to explain this unexpected finding. Within the social stream, off-campus residence remained a strong predictor of IUPS. One implication of this finding is that prevention messages should find appropriate methods to target older students. In addition, we found that students-athletes were more likely to engage in IUPS than their non-athlete peers. Recognition of student-athletes as a high-risk group has a number of implications. For example, those in closest contact with student-athletes (e.g., athletic trainers, tutors, coaches) should be closely involved in the

development and implementation of strategies designed to prevent the behavior by educating student-athletes about its adverse effects, as well as its impact on athletic eligibility if used illicitly. Further training should be provided to these gatekeepers to recognize signs of IUPS and intervene appropriately. Lastly, these findings suggest that although the study of IUPS is relatively new, IUPS is a behavior with proximal correlates (i.e., self-efficacy, behavioral norms, attitudes towards behavior and intention) that parallel other forms of substance use. As such, prevention researchers focused on IUPS may be able to borrow from effective intervention programs already targeting these constructs for other substances.

Limitations

Our survey instrument asks personal questions that are subject to non-response bias. However, that only two respondents of 544 refrained from answering items related to their IUPS speaks to our efforts to use judgment-free wording. With respect to study methods, our study was cross-sectional in nature, which limited our ability to establish temporality. Nonetheless, our analyses were guided by an ecological theory that has a hypothesized temporal flow. Given the ecological nature of the theory utilized, multiple variables were tested and compared in each model. As such, the issue of a Type I error is feasible. However, given the consistency of findings between the original and this replication study, we are reasonably confident the significant associations that were detected are likely to be truly present. An additional limitation related to methodology is that findings may only generalize to demographically- and culturally-similar campuses. However, that our results parallel most results from an administration of the survey at a demographically- and culturally- different campus increases confidence in their external validity.

Our study also has several notable strengths. For example, we expand upon our previous work in a few ways: 1) the study further establishes the psychometric strength of the BEACH-Q; 2) allows for comparison of correlates across demographically different campuses; and 3) by including a qualitative component, the results provide important insight into this high-risk form of substance use. As we previously stated, this latter contribution is a novelty of our study. Although only 23% of contacted instructors permitted entry into their classroom, our use of relatively small monetary incentives resulted in a very high student response rate; moreover, our survey sample was representative of the target population. An additional strength is that the instrument used in this study was an updated version of an already psychometrically strong survey. The revisions made to the theory-guided survey allowed us to better understand key behavioral correlates (e.g., by adding diversion-related items and adding more items for proximal predictors). The revisions also gave us an opportunity to provide new insight into IUPS by giving special attention to students who abstain from IUPS (i.e., through the open-ended item). Lastly, our study's findings suggest the utility of theory in explaining this behavior, and should be used to inform the development of prevention and intervention strategies.

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THE THEORY OF TRIADIC INFLUENCE

Figure 1. The Theory of Triadic Influence

Note: Figure adapted from: Flay, B. R., Snyder, F., & Petraitis, J. (2009). The Theory of Triadic Influence. In R.J. DiClemente, M. C. Kegler & R. A. Crosby (Eds.), *Emerging Theories in Health Promotion Practice and Research* (Second ed., pp. 451–510). New York: Jossey-Bass.

Figure 2. Variables used, and relation to Theory of Triadic Influence. (IUPS = Illicit use of prescription stimulants)

Table 1

Characteristics of students who have engaged in the illicit use of prescription stimulants during college ($N=92$ students).

Characteristics	<i>n</i> (%) ^a
Behavior Initiation	
Initiated behavior before college	21 (25.3%)
Initiated behavior during college	62 (74.7%)
Route of Ingestion^b	
Mouth/Swallow	80 (94.1%)
Nose/Snort	22 (33.9%)
Veins/Inject	3 (4.9%)
Smoke	15 (23.8%)
Other ^c	4 (8.9%)
Cost per Pill^b	
No Charge	57 (78.1%)
\$1–\$5	39 (57.4%)
\$6–\$10	28 (47.5%)
More than \$10	9 (16.7%)
Source of Prescription Stimulants^b	
Myself (Because I have a prescription)	12 (19.4%)
Friend	73 (93.6%)
Family	8 (13.3%)
Acquaintance	34 (51.5%)
Internet	4 (6.7%)
Other	1 (2.1%)
Motives for Use^b	
To improve focus	67 (78.8%)
To make studying more enjoyable	39 (50.1%)
To stay awake for a long time	54 (68.4%)
To improve concentration	63 (78.8%)
To lose weight	6 (8.6%)
To party longer	25 (34.7%)
To experiment	34 (47.2%)
Other	3 (7.9%)
Experienced Desired Outcome^d	
None of the time	6 (7.4%)
A little of the time	15 (18.5%)
Some of the time	9 (11.1%)
Most of the time	31 (38.3%)
All of the time	19 (23.5%)

^aDue to missing data, responses for each question did not always equal the overall sample size. When total responses differed from the total sample size of 92 students, percentages were calculated using total number of non-missing responses per item.

^bThe percentages can exceed 100% because students can check *yes* to more than one item.

^cFour students reported an “Other” route; of these four, two reported anal administration of pills, one reported “melting under tongue,” and the fourth did not provide further detail.

^dPercentages do not add to 100% because some students said *Not Applicable*.

Table 2Nested logistic regression analysis results for the intrapersonal stream of influence ($N=477$ students).

Variables	Model 1 Ultimate Odds Ratio (95% CI)	Model 2 Ultimate + Distal Odds Ratio (95% CI)	Model 3 Ultimate + Distal + Proximal Odds Ratio (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Odds Ratio (95% CI)
Intrapersonal Stream				
<i>Ultimate Underlying Causes</i>				
Inattention ^a	2.09 (1.35, 3.23) **	1.88 (1.12, 3.14) *	1.89 (1.07, 3.32) *	2.32 (1.15, 4.65) *
Hyperactivity ^a	1.05 (0.64, 1.72)	1.00 (0.59, 1.72)	0.84 (0.46, 1.53)	0.76 (0.35, 1.63)
Sensation-Seeking ^a	2.61 (1.83, 3.74) **	3.03 (2.04, 4.48) **	2.46 (1.60, 3.79) **	2.12 (1.23, 3.62) **
Gender				
Female/Other	1.00	1.00	1.00	1.00
Male	1.14 (0.64, 2.03)	1.15 (0.62, 2.15)	1.01 (0.51, 1.99)	0.74 (0.31, 1.79)
Race/Ethnicity				
White	1.00	1.00	1.00	1.00
Asian	0.32 (0.15, 0.66) **	0.35 (0.16, 0.78) *	0.39 (0.17, 0.90) *	0.31 (0.10, 0.90) *
Hispanic/Latino	0.57 (0.26, 1.27)	0.79 (0.33, 1.87)	0.82 (0.33, 2.06)	1.45 (0.45, 4.70)
Other	0.34 (0.12, 0.99) *	0.38 (0.12, 1.20)	0.38 (0.11, 1.32)	0.32 (0.07, 1.49)
Age	0.95 (0.86, 1.05)	0.89 (0.79, 1.00) *	0.91 (0.80, 1.02)	0.91 (0.80, 1.03)
Year in School				
1 st year	1.00	1.00	1.00	1.00
2 nd year	3.87 (1.20, 12.54) *	3.87 (1.15, 13.04) *	3.86 (1.04, 14.34) *	12.89 (2.06, 80.86) **
3 rd year	1.72 (0.54, 5.48)	1.56 (0.47, 5.24)	1.71 (0.48, 6.09)	4.80 (0.88, 26.19)
4 th year	4.81 (1.67, 13.84) **	4.70 (1.52, 14.57) **	4.75 (1.40, 16.11) *	15.29 (2.81, 83.23) **
5 th year or more	16.22 (3.93, 67.01) **	12.37 (2.70, 56.71) **	13.43 (2.59, 69.54) **	50.46 (5.22, 487.76) **
International Status				
Domestic	1.00	1.00	1.00	1.00
International	1.50 (0.52, 4.34)	1.46 (0.50, 4.31)	1.63 (0.55, 4.85)	1.95 (0.53, 7.10)
Enrollment Credits	1.10 (0.99, 1.21)	1.08 (0.97, 1.20)	1.08 (0.96, 1.21)	1.11 (0.96, 1.28)
<i>Distal Predisposing Influences</i>				
Study Habits		0.95 (0.52, 1.75)	0.96 (0.49, 1.88)	0.75 (0.33, 1.72)
Psychological Distress ^b		0.84 (0.52, 1.34)	0.77 (0.46, 1.29)	0.79 (0.42, 1.45)
Academic Concern ^b		1.39 (0.89, 2.16)	1.26 (0.77, 2.07)	1.12 (0.60, 2.09)
Grades				
A		1.00	1.00	1.00
B		0.44 (0.23, 0.87) *	0.52 (0.25, 1.07)	0.40 (0.16, 0.99) *
C		0.38 (0.05, 2.88)	0.34 (0.04, 3.34)	0.13 (0.01, 1.75)
D/F/Not Yet		Set to missing	Set to missing	Set to missing
ADHD Diagnosis				
Never Diagnosed		1.00	1.00	1.00

Variables	Model 1 Ultimate Odds Ratio (95% CI)	Model 2 Ultimate + Distal Odds Ratio (95% CI)	Model 3 Ultimate + Distal + Proximal Odds Ratio (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Odds Ratio (95% CI)
Ever Diagnosed		6.15 (0.79, 47.98)	3.96 (0.41, 38.09)	1.69 (0.12, 21.40)
Prescription Stimulant				
Prescription				
No Prescription		1.00	1.00	1.00
Prescription		1.71 (0.23, 12.76)	1.59 (0.17, 15.03)	6.14 (0.46, 82.19)
<i>Proximal Immediate Predictors</i>				
Avoidance Self-Efficacy ^c			0.39 (0.28, 0.54) ^{**}	1.00 (0.61, 1.62)
<i>Immediate Precursors</i>				
IUPS Intentions ^d				8.88 (4.89, 16.11) ^{**}
<i>Pseudo-R²</i>	25.34%	31.44%	39.85%	59.70%
<i>Log Likelihood</i>	-161.05	-147.89	-129.75	-86.94

Note. Each of the four blocks significantly contributed to the final model. ADHD = Attention deficit hyperactivity disorder; IUPS = Illicit use of prescription stimulants.

^aResponse options for items in composite measure range from 1 = *Strongly disagree* to 5 = *Strongly agree*

^bResponse options for items in composite measure range from 1 = *None of the time* to 5 = *All of the time*

^cResponse options for items in composite measure range from 1 = *Not at all confident* to 5 = *Completely confident*

^dResponse options for items in composite measure range from 1 = *Definitely won't* to 4 = *Definitely will*

* $p < 0.05$.

** $p < 0.01$.

Table 3

Nested logistic regression analysis results for the social situation/context stream of influence ($N=534$ students).

Variables	Model 1 Ultimate Odds Ratio (95% CI)	Model 2 Ultimate + Distal Odds Ratio (95% CI)	Model 3 Ultimate + Distal + Proximal Odds Ratio (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Odds Ratio (95% CI)
Social Situation/Context Stream				
<i>Ultimate Underlying Causes</i>				
Residence				
Off-Campus Housing	1.00	1.00	1.00	1.00
Other Housing	0.47 (0.24, 0.89) *	0.38 (0.18, 0.83) *	0.40 (0.19, 0.88) *	0.17 (0.06, 0.48) **
<i>Distal Predisposing Influences</i>				
Greek Life				
Non-member		1.00	1.00	1.00
Member		2.30 (1.16, 4.53) *	1.96 (0.97, 3.98)	1.77 (0.76, 4.13)
Varsity Sports				
Non-member		1.00	1.00	1.00
Member		2.32 (1.11, 4.84) *	2.00 (0.93, 4.28)	3.13 (1.22, 8.06) *
Perceptions of IUPS by Socializing Agents ^a				
Friends		1.82 (1.14, 2.91) *	1.70 (1.05, 2.73) *	1.66 (0.91, 3.03)
Family		1.49 (0.96, 2.33)	1.48 (0.94, 2.34)	0.91 (0.51, 1.62)
Faculty/Staff		0.55 (0.35, 0.87) *	0.59 (0.37, 0.96) *	0.91 (0.51, 1.52)
Endorsement of IUPS by Socializing Agents ^b				
Friends		2.83 (2.00, 4.02) **	2.15 (1.49, 3.11) **	1.73 (1.10, 2.73) *
Family		1.26 (0.63, 2.53)	1.02 (0.49, 2.12)	0.62 (0.28, 1.37)
Faculty/Staff		1.05 (0.54, 2.02)	1.27 (0.65, 2.47)	1.58 (0.76, 3.29)
Motivation to Comply ^c		0.89 (0.70, 1.08)	0.87 (0.70, 1.08)	0.97 (0.75, 1.25)
<i>Proximal Immediate Predictors</i>				
Perception of Prevalence Rates ^d			1.04 (0.74, 1.47)	1.30 (0.86, 1.97)
Campus IUPS			1.70 (1.28, 2.26) **	1.22 (0.85, 1.74)
Friends IUPS				
<i>Immediate Precursors</i>				
IUPS Intentions ^e				5.68 (3.68, 8.77) **
Pseudo-R ²	1.27%	30.56%	34.39%	52.69%
Log Likelihood	-240.69	-169.28	-159.96	-115.33

Note. Each of the four blocks significantly contributed to the final model. IUPS = Illicit use of prescription stimulants.

^aResponse options for items range from 1 = *Very negatively* to 5 = *Very positively*

^bResponse options range from 1 = *None* to 5 = *All*

^cResponse options range from 1= *Strongly disagree* to 5 = *Strongly agree*

^dResponse options for composite range from 1 = *0%* to More than 6 = *75%*

^eResponse options for items in composite measure range from 1 = *Definitely won't* to 5 = *Definitely will*

*
 $p < 0.05$.

**
 $p < 0.01$.

Table 4Nested logistic regression analysis results for the sociocultural environment of influence ($N=533$ students).

Variables	Model 1 Ultimate Odds Ratio (95% CI)	Model 2 Ultimate + Distal Odds Ratio (95% CI)	Model 3 Ultimate + Distal + Proximal Odds Ratio (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Odds Ratio (95% CI)
Sociocultural Environment Stream				
<i>Ultimate Underlying Causes</i>				
Financial-Health ^a	1.11 (0.87, 1.41)	1.19 (0.93, 1.52)	1.23 (0.95, 1.59)	1.12 (0.83, 1.52)
Participation in Religious Activities ^b	0.92 (0.73, 1.17)	1.01 (0.79, 1.30)	1.09 (0.84, 1.41)	1.14 (0.83, 1.55)
Exposure to Rx Drug Media on Television ^c	1.21 (0.80, 1.82)	1.13 (0.74, 1.75)	1.13 (0.74, 1.73)	1.37 (0.83, 2.25)
Exposure to Rx Drug Print Media ^c	0.95 (0.62, 1.46)	1.00 (0.64, 1.57)	1.04 (0.67, 1.63)	0.92 (0.55, 1.54)
Campus Culture – Perception of Academic Demand #1 ^c	0.74 (0.48, 1.14)	0.74 (0.48, 1.14)	0.85 (0.53, 1.34)	0.71 (0.40, 1.27)
Campus Culture – Perception of Academic Demand #2 ^c	0.96 (0.67, 1.39)	0.79 (0.53, 1.19)	0.81 (0.53, 1.22)	0.81 (0.50, 1.29)
Campus Culture – Perception of Substance	1.75 (1.22, 2.52) **	1.62 (1.11, 2.35) *	1.39 (0.95, 2.04)	1.30 (0.85, 2.01)
Use During College ^c Campus Culture – Perception of Health Care Providers Prescription writing ^c	1.08 (0.80, 1.46)	1.03 (0.75, 1.42)	1.08 (0.78, 1.49)	1.07 (0.73, 1.55)
Diversion ^d	6.66 (4.10, 10.79) **	5.45 (3.32, 8.94) **	5.55 (3.33, 9.25) **	4.37 (2.46, 7.76) **
<i>Distal Predisposing Influences</i>				
Interactions with Social Institutions ^c		1.04 (0.74, 1.45)	1.03 (0.73, 1.46)	1.10 (0.72, 1.67)
Interactions with Social Institutions Influencing Values ^c		1.17 (0.85, 1.62)	1.29 (0.92, 1.80)	1.43 (0.97, 2.10)
IUPS Expectancies ^b				
Positive Expectancies		2.28 (1.56, 3.34) **	1.95 (1.31, 2.89) **	1.24 (0.78, 1.98)
Negative Expectancies		0.500 (0.34, 0.74) **	0.58 (0.39, 0.87) **	0.65 (0.41, 1.03)
<i>Proximal Immediate Predictors</i>				
Attitudes towards IUPS ^c			1.99 (1.42, 2.81) **	0.95 (0.59, 1.54)
Immediate Precursors IUPS Intentions ^e				5.22 (3.26, 8.35) **
Pseudo-R ²	30.44%	35.75%	39.08%	52.30%
Log Likelihood	– 168.36	– 155.49	– 147.43	– 115.43

Note. Each of the four blocks significantly contributed to the final model. IUPS = Illicit use of prescription stimulants.

^aResponse options for item ranges from 1 = *Poor* to 5 = *Excellent*

^bResponse options for items in composite range from 1 = *None of the time* to 5 = *All of the time*

^cResponse options for items in composite range from 1 = *Strongly agree* to 5 = *Strongly disagree*

^dResponse options for items in composite range from 1 = *Never* to 8 = *40 or more times*

^eResponse options for items in composite measure range from 1 = *Definitely won't* to 4 = *Definitely will*

*
 $p < 0.05$.

**
 $p < 0.01$.

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