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Illicit Use of Prescription Stimulants in a College Student Sample: A Theory-Guided Analysis*

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Abstract

Background—The illicit use of prescription stimulants (IUPS) has emerged as a high-risk behavior of the 21st century college student. As the study of IUPS is relatively new, we aimed to understand 1) characteristics of IUPS (i.e., initiation, administration routes, drug sources, motives, experiences), and 2) theory-guided intrapersonal, interpersonal, and environmental correlates associated with use.

Methods—Using one-stage cluster sampling, 520 students (96.3% response rate) at one Pacific Northwest University completed a paper-based, in-classroom survey on IUPS behaviors and expected correlates. Aim 1 was addressed using descriptive statistics and aim 2 was addressed via three nested logistic regression analyses guided by the Theory of Triadic Influence.

Results—The prevalence of ever engaging in IUPS during college was 25.6%. The majority (>50.0%) of users reported initiation during college, oral use, friends as the drug source, academic motives, and experiencing desired outcomes. Intrapersonal correlates associated with use included identifying as White, lower grade point average, diagnoses of attention deficit disorder, and lower avoidance self-efficacy. Interpersonal correlates of use included off-campus residence, varsity sports participation, IUPS perceptions by socializing agents, and greater behavioral norms.

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Contributors
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Conflict of Interest
All authors declare that they have no conflicts of interest.

Exposure to prescription drug print media, greater prescription stimulant knowledge, and positive attitudes towards prescription stimulants were environmental correlates associated with use. In all models, IUPS intentions were strongly associated with use.

Conclusions—IUPS was prevalent on the campus under investigation and factors from the intrapersonal, interpersonal and environmental domains were associated with the behavior. Implications for prevention and future research are discussed.

Keywords

Prescription stimulants; College students; Health behavior theory

1. INTRODUCTION

Prescription stimulants used to treat conditions including attention deficit hyperactivity disorder (e.g., amphetamines), are a class of drugs with high potential for abuse, dependence, and adverse effects on physical and psychological health (Nissen, 2006; White et al., 2006; National Institute on Drug Abuse, 2008, 2009; Gould et al., 2009). Moreover, the *illicit use* of prescription stimulants (IUPS; use of *any* prescription stimulant without a prescription from a health care provider, use for nonmedical purposes, and/or use in excess of what is prescribed) has emerged as a substance use behavior of the 21st century college student (e.g., Johnston et al., 2011). Although students view this behavior as a safe alternative to other drug use (Cicero et al., 2005; DeSantis et al., 2008, 2009), the potential for ill health underscores the need to better understand correlates of use.

Trends in emergency department visits related to prescription stimulants highlight the growing impact prescription stimulant use and misuse are having on the public's health, and the health of young adults in particular (Substance Abuse and Mental Health Services Administration (SAMHSA), 2013). According to the Drug Abuse Warning Network surveillance system (SAMHSA, 2013), the overall number of emergency department visits related to prescription stimulants more than doubled between 2005 (i.e., 13,379 visits) and 2010 (i.e., 31,244 visits). Among adults aged 18 and older, visits related to adverse reactions from prescribed use increased significantly from 1,637 to 4,983 during this time period; the corresponding increase for visits by adults related to nonmedical use increased significantly from 3,175 to 13,570. Among young adults of college age (i.e., 18 to 25 years), the prevalence of emergency department visits related to nonmedical use has increased substantially from 2005 (i.e., 1,310 visits) to 2010 (i.e., 5,766 visits), highlighting the need to focus prevention research efforts on this higher-risk population.

Initial investigations of IUPS in the college population have provided information on the prevalence, motives and individual-, social-, and school-level characteristics associated with the behavior. In the 119 campus College Alcohol Study, past-year prevalence of self-reported nonmedical use of amphetamines ranged from 0.0% to 25.0% (McCabe et al., 2005). Compared to other drugs, which are often used for social and recreational purposes, motives for IUPS are predominately academic in nature (e.g., to improve alertness, concentration, and studying; Teter et al., 2006). Studies have shown IUPS is more likely among males (Low and Gendaszek, 2002; Hall et al., 2005; McCabe et al., 2005; DeSantis et al., 2008; Rabiner et al., 2009), upperclassmen under the age of 24 (Babcock and Byrne, 2000; DeSantis et al., 2008), and students who identify as White (McCabe et al., 2005; Teter et al., 2006; Herman-Stahl et al., 2007; DeSantis et al., 2008; DuPont et al., 2008; Rabiner et al., 2009). In addition, studies have demonstrated a greater prevalence of IUPS amongst students involved in Greek life as compared to students not participating in a social fraternity or sorority (McCabe et al., 2005; Shillington et al., 2006; DeSantis et al., 2008;

McCabe, 2008; Rabiner et al., 2009; Weyandt et al., 2009). Lastly, given the academic motives for IUPS, it is not surprising that past-year IUPS has been found to be higher at colleges with competitive and highly competitive admissions standards, as compared to colleges with less selective admissions standards (McCabe et al., 2005). In spite of the information provided by these initial investigations of IUPS, research gaps remain.

To date, gaps in the IUPS literature include the lack of an instrument that includes both a definition of IUPS and a set of testable theoretical correlates of use that are comprehensive in nature (Arria and Wish, 2006; Bavarian et al., 2012). For example, some surveys ask only about methylphenidate use (e.g., Babcock and Byrne, 2000; DuPont et al., 2008) even though other classes of prescription stimulants (i.e., amphetamines and dextroamphetamines) are available. Lack of a unified definition is problematic, as it may lead to an underestimation of prevalence and/or biased conclusions about predictors of IUPS. The lack of a comprehensive universal instrument to study IUPS is problematic as it has led researchers to examine different sets of predictors. Additionally, surveillance systems that provide a wealth of knowledge on college student health behaviors and attitudes (e.g., the American College Health Association's National College Health Assessment II) have not been able to elucidate proximal correlates of use specific to IUPS (e.g., self-efficacy, behavioral norms, attitudes, intentions; Bavarian et al., 2013). These gaps should be bridged, as development of prevention and intervention programs require a comprehensive understanding of a health behavior.

The Behaviors, Expectancies, Attitudes, and College Health Questionnaire (BEACH-Q; Bavarian et al., 2013), an instrument guided by the Theory of Triadic Influence (Flay and Petraitis, 1994; Flay et al., 2009) was created to address the aforementioned research gaps. Using the BEACH-Q, our first aim was to examine characteristics of IUPS (i.e., IUPS initiation, frequency of use, routes of administration, prescription stimulants sources, IUPS motives, and experiences with illicit use). Our second aim was to understand theory-guided intrapersonal, interpersonal, and environmental correlates of IUPS.

2. METHODS

2.1. Study Design

We utilized one-stage cluster sampling. Simple random sampling was conducted on all classes at a Pacific Northwest University offered during the Winter 2012 academic term meeting inclusion criteria (e.g., undergraduate classes, with an instructor name on record, that were not special research courses). Instructors of randomly selected courses were contacted via e-mail requesting permission to have their class participate in a 15-20 minute survey. On the day of surveying, all students were provided with a copy of the survey, informed of the voluntary and anonymous nature of the survey, and asked to participate if eligible (i.e., at least 18 years of age and an undergraduate). Students choosing to participate were compensated with a $2.50 gift certificate to a campus vendor. The study methods were approved by the university's Institutional Review Board.

2.2. Participants

Overall, 520 students from 20 classrooms participated in the survey (response rate = 96.3%). A total of 79.0% of the students self-identified as White, 8.2% as Asian/Pacific Islander, 5.2% as Hispanic and 7.6% as Other. The majority of participants were female (55.2%), under the age of 25 (92.3%), and enrolled in school full-time (99.0%). Percentage breakdown by year in school was as follows: 12.4% 1st year, 21.3% 2nd year, 24.9% 3rd year, 27.6% 4th year, 13.4% 5th year or more, and 0.4% Post-baccalaureate. Supplemental

analyses demonstrated the survey sample was similar to the total undergraduate population (results not shown).

2.3. Theoretical Guide

The BEACH-Q and this study's analyses were guided by Theory of Triadic Influence (TTI; Flay and Petraitis, 1994; Flay et al., 2009). The TTI, described in detail elsewhere (Flay and Petraitis, 1994; Flay et al., 2009; Bavarian et al., 2012), is an ecological approach to explaining and predicting health behaviors. The TTI was selected as the theoretical guide because its meta-theoretical framework allows constructs from a multitude of theories (e.g., the theory of planned behavior (Ajzen, 1988), social cognitive theory (Bandura, 1986), and expectancy-value theories (Feather, 1982)) to be examined for association with IUPS.

Briefly, the TTI classifies independent variables by stream of influence and level of causation. The three streams of influence are the intrapersonal (i.e., characteristics of one's biology, personality, and demography that influence behavioral self-efficacy), social situation/context (i.e., characteristics in an individual's immediate social setting(s) that contribute to social normative beliefs) and sociocultural environment (i.e., macro-level social and cultural factors that contribute to a behavior by influencing attitudes towards that behavior). The four levels of causation are ultimate causes, distal influences, proximal predictors and immediate precursors; an individual's level of control over a variable increases as one goes from ultimate cause to immediate precursor.

2.4. Measures

The development and psychometric properties of the BEACH-Q have been discussed in detail elsewhere (Bavarian et al., 2013; an abbreviated list of sample items by stream of influence and level of causation can be found in Supplementary Material[1]). Briefly, ultimate level variables of the intrapersonal stream were *inattention* (composite score (i.e., an average of the items used to create the measure)), *hyperactivity* (composite score), *sensation-seeking* (composite score), *gender* (categorical (i.e., male, female, transgender)), *race/ethnicity* (categorical), *age* (continuous), *year in school* (categorical), *international student status* (binary), and *enrollment credits* (continuous). *Psychological distress* (composite score), *academic concern* (composite score), *grades* (categorical), and *Attention Deficit Hyperactivity Disorder* [ADHD] diagnoses (binary) were distal-level measures of the intrapersonal stream. Lastly, prescription stimulant *avoidance self-efficacy* (composite score) was a proximal-level measure of the intrapersonal stream.

Residence (categorical) was included as an ultimate level variable of the social situation/context stream of influence. Measures included at the distal level were *Greek Life* (binary), *varsity sports* (binary), *relationship status* (binary), and *strength of relationships* (continuous), *perceptions* (i.e., positive or negative) *of IUPS* (continuous), and *endorsement of IUPS* (continuous) by socializing agents (i.e., family, friends, and campus faculty/staff). *Behavioral norms* were assessed at the proximal level.

Ultimate-level variables of the sociocultural environment stream were *financial-related stress* (continuous), *participation in religious activities* (composite), *exposure to prescription drug media* on television and in print (continuous), *perception of academic demand* (continuous), *perception of substance use during college* (continuous), and perception of health care providers prescription drug writing (continuous). Distal-level variables included *interactions with social institutions* (i.e., focus on academic performance by faculty; continuous), interactions with social institutions influencing values (i.e., value placed on

[1]Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:…

academic performance by student; continuous), *information* (i.e., provided by health care providers regarding prescription stimulants; continuous), *information influencing knowledge* (continuous), and *IUPS expectancies* (composite). Expectancies fall towards the proximal end of the distal range, but are classified as distal measures because they are predictors of attitudes towards a behavior. *Knowledge* about prescription stimulants (composite) and *attitudes towards prescription stimulants* (composite) were included as proximal-level variables.

IUPS intention (immediate precursor; continuous) assessed a student's perceived likelihood of engaging in IUPS. To examine related behaviors, students were asked about their frequency of alcohol, marijuana, tobacco, prescription painkillers (illicit use), and *cocaine* use.

To measure *IUPS during college*, students were first asked if, during their time in college, they had ever used prescription stimulants "without a prescription from a health care provider", "for nonmedical purposes (i.e., to help with studying, to stay awake, to get high)", or "in excess of what was prescribed to you". Students were then asked how frequently they engaged in the behavior (1 = Never; 7 = 40 or more occasions per term). Students indicating a positive response to either of the IUPS or frequency items were labeled as having ever engaged in IUPS during college.

Students were also asked to indicate when, if ever, they *initiated IUPS*. Students who reported ever engaging in IUPS during their lifetime were then directed to items regarding routes of ingestion, sources of prescription stimulants, motives for use, and whether they *experienced the outcome they desired*. Students not engaging in IUPS were not asked these questions.

2.5. Data Analysis

IUPS-related behaviors of current illicit users were tabulated to attain aim 1. For aim 2, nested logistic regression models (Long and Freese, 2006) were estimated for each TTI-based stream of influence (i.e., intrapersonal, social situation, and environmental), with covariates from each level of influence (ultimate, distal, proximal, immediate precursor) introduced in a stepwise fashion. This analytical approach was employed for two reasons: 1) we aimed to provide a comprehensive, as opposed to parsimonious, picture of how the theoretical predictors are/are not associated with IUPS. 2) By examining each stream of influence independently, and building the model sequentially, we aimed to provide insight on the mechanisms by which these predictors may exert their influence on IUPS within streams. Because preliminary analyses did not demonstrate clustering of IUPS by classroom (i.e., Median Odds Ratio = 1.00), the analyses were not hierarchical in nature.

3. RESULTS

3.1. IUPS and other forms of substance use

The prevalence of IUPS during college was 25.6%, and frequency of use per academic term varied; that is, 52.9% of users used 1-2 times, 24.4% used 3-5 times, 9.2% used 6-9 times, 5.0% used 10-19 times, 5.0% used 20-39 times, and 3.4% used 40 or more times per term. The prevalence of ever engaging in IUPS during college was less than the prevalence of ever engaging in the use of alcohol (87.0%), marijuana (40.7%), and tobacco (40.4%) during college, but greater than the prevalence of ever engaging in the illicit use of prescription pain killers (14.5%) and cocaine (7.2%) during college (results not shown).

3.2. Aim 1: Characteristics of IUPS

Table 1 presents characteristics of IUPS for college users (N = 133). Over 70.0% initiated the behavior in college. Although 93.7% of users reported oral ingestion, 20.8% engaged in intranasal ingestion, and 4.4% reported other routes of ingestion (e.g., smoking, dissolving in a liquid and drinking). The predominant sources of prescription stimulants were friends (87.1%) and acquaintances (30.4%), though 26.4% of students engaging in IUPS reported themselves as the source, stating that they had a prescription for the drug (N=29 of 110 responders). The top four motives for use were academic-related (e.g., to improve focus, to improve concentration, to stay awake, and to make studying more enjoyable), and 67.7% agreed or strongly agreed they experienced the outcome from IUPS they desired.

3.3. Aim 2: Correlates of IUPS

3.3.1. Intrapersonal Stream of Influence—In the intrapersonal stream of influence's ultimate-level-only model (Table 2, Model 1), five covariates had a significant association with IUPS. One unit increases in inattention, hyperactivity, and sensation-seeking were all associated with increased odds of engaging in IUPS. Asian students were 80.0% less likely to report engaging in IUPS than White students, and students in their 3rd, 4th or 5th year in college were 3 to 5 times more likely to report engaging in IUPS than 1st year students. Follow-up analyses showed an increasing positive trend across the ordered levels of year in school (results not shown).

After introducing distal predisposing influences (Table 2, Model 2), three of the ultimate underlying causes (i.e., sensation-seeking, race/ethnicity, and year in school) remained significantly associated with IUPS. Moreover, students earning "B's" and "C's" had higher odds of engaging in IUPS, compared to students earning "A's".

The inclusion of avoidance self-efficacy (Table 2, Model 3) resulted in two ultimate underlying causes, three distal predisposing influences, and the sole proximal immediate predictor having a significant association with IUPS. Asian students continued to have lower odds of engaging in IUPS than White students, and 4th year students continued to have higher odds of engaging in IUPS than 1st year students. Academic concern and ADHD diagnoses, which did not have a significant association with IUPS in Model 2, had significant associations with IUPS in Model 3. A one unit increase in academic concern significantly increased the odds of engaging in IUPS by 74.0% ($p < 0.05$). Also, as compared to students without an ADHD diagnosis, student with a diagnoses were 2.48 times more likely to engage in IUPS ($p < 0.05$). Lastly, a one unit increase in avoidance self-efficacy was associated with an 80.0% decrease in the odds of engaging in IUPS.

In the full model (Table 2, Model 4), correlates associated with use included race/ethnicity, grades, diagnoses of attention deficit disorder, avoidance self-efficacy, and IUPS intentions (Adjusted Odds Ratio [AOR] (95% Confidence Interval) = 6.31 (3.61, 11.01), $p < 0.01$).

3.3.2. Social Situation/Context Stream of Influence—In Model 1 (Table 3) of the nested analyses for the social situation/context stream of influence, students living in campus housing, as compared to students living off-campus, were significantly less likely to engage in IUPS (AOR = 0.23 (0.10, 0.51), $p < 0.01$).

After adding distal predisposing influences (Table 3, Model 2), residence remained significantly associated with IUPS. In addition, as compared to non-participants, students participating in varsity sports had higher odds of engaging in IUPS (AOR = 2.22 (1.08, 4.58), $p < 0.05$). A one unit increase in the perception that friends (AOR = 1.86 (1.20, 2.88), $p < 0.01$) and family (AOR = 2.05 (1.33, 3.17), $p < 0.01$) would react positively to a

student's IUPS was positively associated with IUPS, whereas a one unit increase in perceived positive reaction to IUPS by faculty and staff had an inverse association with IUPS (AOR = 0.66 (0.45, 0.95), $p < 0.05$). The odds of engaging in IUPS also increased (AOR = 3.00 (2.12, 4.25), $p < 0.01$) for every one unit increase in friends' endorsement of IUPS.

With the inclusion of behavioral norms (Table 3, Model 3), residence, varsity sports participation, perception of IUPS by friends, family, and faculty and staff, and endorsement of IUPS by friends remained significantly associated with IUPS. In addition, a significant positive association with IUPS was observed for the perceived prevalence of IUPS among friends (AOR = 1.03 (1.01, 1.05), $p < 0.01$).

In the full model (Table 3, Model 4), IUPS intention was significantly associated with IUPS (AOR = 6.47 (3.96, 10.56), $p < 0.01$), and residence, varsity sports participation, perceptions of IUPS by family and faculty/staff, and behavioral norms of friends remained significantly associated with the behavior.

3.3.3. Sociocultural Environment Stream of Influence—In the ultimate-level-only nested analyses for the sociocultural environment stream of influence (Table 4, Model 1), four covariates were significantly associated with IUPS. The odds of engaging in IUPS increased 22.0% for every unit increase in financial-related stress. In addition, the odds of engaging in IUPS decreased 33.0% for every unit increase in participation in religious activities. Exposure to prescription drug advertisements on television was associated with increased odds of IUPS, whereas exposure to advertisements in print media was associated with decreased odds of IUPS.

After the inclusion of distal predisposing influences (Table 4, Model 2), three of the ultimate underlying causes (i.e., participation in religious activities and exposure to prescription drug advertisements in television and print media) remained significantly associated with IUPS. Of the distal predisposing influences, positive (AOR = 3.41 (2.51, 4.65), $p < 0.01$) and negative (AOR = 0.63 (0.47, 0.83), $p < 0.01$) IUPS expectancies were significantly associated with IUPS.

In Model 3 (Table 4), the associations between IUPS and participation in religious activities, exposure to prescription drug print media, and positive and negative expectancies remained significant. In addition, the odds of engaging in IUPS increased significantly for every unit increase in prescription stimulant knowledge and attitudes towards prescription stimulants.

In the final model (Table 4, Model 4), exposure to prescription drug print media, prescription stimulant knowledge, attitudes towards prescription stimulants and IUPS intentions (AOR = 5.70 (3.73, 8.70), $p<0.01$) were associated with IUPS.

3.3.4. IUPS and Other Drug Use—Supplemental analyses looked at the relationship between IUPS and a composite measure consisting of frequency of use of five drugs (i.e., alcohol, tobacco, marijuana, cocaine, and illicit use of prescription painkillers) per academic term. In unadjusted logistic regression analyses, this composite measure of related behavior was significantly associated with IUPS, whereby every one unit increase in substance use frequency was associated with a 3.62 increased odds of engaging in IUPS (Unadjusted OR (95% Confidence Interval) = 3.62 (2.82, 4.66), $p < 0.01$).

4. DISCUSSION

We found that 1 in 4 students reported ever engaging in IUPS during college, and over 70.0% of these users initiated the behavior during college. Frequency of use varied, with most (>86.0%) students engaging in the behavior between 1 to 9 times per academic term. Although most students (93.7%) reported oral ingestion, 20.8% reported intranasal ingestion and 4.4% reported alternative routes of ingestion. This finding is worrisome as the risk of dependence increases any time a drug is taken in a manner in which it was not intended (Volkow and Swanson, 2003). Also worrisome is the finding that friends and acquaintances were the primary source of prescription stimulants, as peers may be less aware of another person's medical allergies, pre-existing conditions and potential for harmful medical interactions (Goldsworthy et al., 2008). Similar to past studies (e.g., Low and Gendaszek, 2002; Teter et al., 2006; DuPont et al., 2008; Judson and Langdon, 2009), the top motives for IUPS were academic in nature. Nonetheless, it is noteworthy that 22.5% and 30.7% of current users engaged in the behavior to party longer and to experiment, respectively. Moreover, the finding that nearly 70.0% of students agreed or strongly agreed that engaging in this behavior produced the outcome they desired highlights the potential difficulty that will face researchers and student service professionals aiming to prevent IUPS on college campuses.

In the intrapersonal stream of influence's final model, race/ethnicity (ultimate), academic grades and ADHD diagnoses (distal), avoidance self-efficacy (proximal), and IUPS intentions (immediate precursor) were significantly associated with IUPS. With respect to ultimate-level measures, Asian students were found to be less likely to engage in IUPS than White students. These findings parallel prior research examining race/ethnicity (e.g., McCabe et al., 2005; Teter et al., 2006; DuPont et al., 2008; DeSantis et al., 2008; Tuttle et al., 2010). Unlike prior research (e.g., Low and Gendaszek, 2002; Hall et al., 2005; McCabe et al., 2005; DeSantis et al., 2008; Vidourek et al., 2010), no association was observed between gender and IUPS. These results may be partially explained by recent studies showing the gender gap for substance use is narrowing (e.g., Keyes et al., 2008). With respect to distal predisposing influences, in the full model, students with a diagnosis of ADHD (who may have greater access to prescription stimulants) and students earning "B's" and "C's" (who may have greater academic motives), as compared to students earning "A's", were more likely to engage in IUPS. These results parallel prior research on ADHD (e.g., Tuttle et al, 2010) and academic grades (e.g., McCabe et al., 2005; Shillington et al., 2006; Arria et al., 2008; Lord et al., 2009; Rabiner et al., 2009; Weyandt et al., 2009). Lastly, avoidance self-efficacy, the proximal immediate predictor in the intrapersonal stream of influence, was significantly associated with IUPS in the full model. This study is the first to examine IUPS avoidance self-efficacy, and results related to this measure have prevention implications (discussed below).

Ultimate underlying causes (i.e., off-campus residence), distal predisposing influences (i.e., varsity sports participation, perception of IUPS by socializing agents), proximal immediate predictors (i.e., greater behavioral norms), and the immediate precursor (i.e., IUPS intentions) in the social situation/context stream of influence were found to be associated with IUPS in the full model. The association between IUPS and varsity sports participation has had mixed results in prior studies, with some researchers (Ford, 2008) finding a relationship, and others (Bavarian et al., 2013), not finding a relationship. The null finding for Greek Life participation contrasts with a multitude of studies (e.g., McCabe et al., 2005; Shillington et al., 2006; DeSantis et al., 2008; McCabe, 2008, Lord et al., 2009; Rabiner et al., 2009; Weyandt et al., 2009; Bavarian et al., 2013) that have shown a positive association between IUPS and Greek life. As expected, perceptions that family members would react more positively to IUPS was associated with IUPS, while unexpectedly, perceptions of a

more positive reaction from faculty and staff was inversely associated with IUPS. These results should be further investigated. Lastly, students who perceived that a greater percentage of their close friends engaged in IUPS were more likely to engage in IUPS themselves. That peer behavioral norms have a strong influence on personal behavior is a finding that has been observed not only in the IUPS literature (Judson and Langdon, 2009), but also in the literature on other substance use behaviors in college, such as alcohol (Perkins, 2002).

In the full model examining IUPS correlates in the sociocultural environment stream, exposure to prescription drug print media (ultimate underlying causes), prescription stimulant knowledge and attitudes towards prescription stimulants (proximal immediate predictors), and IUPS intentions (immediate precursor) were significantly associated with IUPS. In the United States, direct-to-consumer advertising is a $4.9 billion dollar industry (Health IMS, 2008 as cited in Frosch et al., 2010) and while television ads may include creative ways of diverting attention from the adverse effects associated with a drug (e.g., through the use of pleasant imagery during discussions of adverse effects), print advertisements define adverse effects without diversion. This may, in part, explain the conflicting associations observed between IUPS and television versus print media. With respect to proximal immediate predictors, as demonstrated in prior research (e.g., Judson and Langdon, 2009) students engaging in IUPS were likely to be more knowledgeable of prescription stimulants, but have more positive attitudes towards prescription stimulants.

This is one of the first studies to examine IUPS intentions, and that the item was significantly associated with IUPS in all analyses illustrates the importance of understanding the factors that influence intentions. Moreover, the sequential build-up of models highlighted the impact of intentions on IUPS, suggesting that intentions most likely mediate the effects of some of the measured ultimate- and distal-level covariates, as measures significantly associated with IUPS in earlier models (e.g., inattention, hyperactivity, sensation-seeking, participation in religious activities, and IUPS expectancies) were no longer significantly associated with IUPS in the full models.

4.1. Limitations and Strengths

With respect to the key variables of interest in this project, students' self-reported experiences with substance use, as well as measures of psychological distress, academic concern, and grade point average are subject to non-response and social desirability bias. However, missing data was not an issue in this data set (e.g., for the dependent variable, there was a response from all 520 students), and pilot tests of the survey showed students did not find the instrument judgmental in nature (Bavarian et al., 2013). A limitation of the survey is that although it asked students engaging in IUPS whether they received the outcome they intended, students were not asked to elaborate on adverse health effects. Additional limitations are that this study was cross-sectional in nature and took place at one university. Cross-sectional studies impact the ability to establish temporal ordering and test causal hypotheses. Additionally, limiting the study to one university limited the generalizeability of findings to demographically- and culturally-similar universities that would select to participate in a study of this nature.

In spite of these limitations, the study has several strengths. With respect to study design, we used probability sampling and obtained both a high student response rate and a representative sample of the undergraduate student population. An additional strength is that the data collection and analytic plan were guided by a comprehensive health behavior theory, the TTI. While individual studies of IUPS have examined different constructs embedded in the TTI, to date, we are aware of only one study that explored one component of IUPS (i.e., non-prescription use) using the TTI (Bavarian et al., 2013). The limitation of

this previous exploratory study is that the instrument used in the analyses did not include important constructs embedded within the TTI (e.g., expectancies, avoidance self-efficacy, social normative beliefs, and intentions). Our study expands upon this past study through the use of a valid and reliable instrument (i.e., The BEACH-Q) that not only more comprehensively defines prescription stimulant misuse, but that was also developed in alignment with the TTI, allowing us to examine a greater number of theoretically hypothesized correlates. Therefore, use of the BEACH-Q in this study, and examination of a broad range of correlates of IUPS by stream of influence, is a unique and important contribution. Although some of the underlying concepts defined by the TTI and included in the BEACH-Q are not new to the study of IUPS (e.g., expectancies, normative beliefs), this study provides a first look into the associations between IUPS and new concepts (i.e., IUPS avoidance self-efficacy and IUPS intentions). Moreover, the fact that a number of findings in our study replicate what other studies on the topic have found adds a degree of confidence to the findings of this and previous studies. Lastly, the use of a comprehensive theory to examine IUPS allows for the development of a more comprehensive strategic plan for prevention and intervention.

4.2. Prevention and Research Implications

To date, universities have begun to address IUPS (e.g., The Generation Rx Initiative at The Ohio State University); however, no research exists on the effectiveness of prevention efforts. The multifaceted nature of IUPS, and the support it lends to one premise of the TTI (i.e., that behavior is multi-etiological), underscore the importance of engaging in multi-pronged approaches that will address intrapersonal and broader factors associated with the behavior. One benefit of the TTI is that it can be used to predict, and therefore implement strategies designed to prevent, behavior.

According to the TTI, action targeting the intrapersonal steam of influence should aim to influence feelings of self-efficacy and behavioral control. In our study, students with lower avoidance self-efficacy were more likely to engage in IUPS. For example, students who were less confident about their ability to avoid IUPS when they had a large amount of work to do in a small amount of time had higher odds of engaging in IUPS. As such, health educators and academic advisors should continue teaching students time-management skills (Arria et al., 2010).

Strategies could also be employed that influence the TTI's social situation/context stream, with the goal being to influence social normative beliefs. For example, social norms campaigns could be used to correct misperceptions between the perceived versus actual prevalence of IUPS. Should a small discrepancy exist between behavioral norms and actual behavior prevalence, whereby limiting the potential impact of a social norms campaign, social marketing techniques that promote adoption of healthy academic behaviors (e.g., setting daily goals) could be employed, given the academic-related motives for use.

Action could also be taken to influence attitudes towards IUPS, which the TTI posits is a proximal predictor of the sociocultural environment stream. For example, results from the sequential building of our model suggest that expectancies have an indirect influence on IUPS intentions. As such, clarifying positive expectancies and affirming negative expectancies may help to influence attitudes and, therefore, intentions. For example, students who felt engaging in IUPS would improve academics (positive expectancy) were more likely to engage in the behavior. However, students earning "A's" were less likely to engage in IUPS than students earning "B's" and "C's"; thus the study habits of "A" students could be highlighted in campaigns. Also, students who felt they would get in trouble if they engaged in IUPS (a negative expectancy) were less likely to engage in IUPS. One

possibility, therefore, is to further highlight the illegality of, and advocate for the enforcement of laws related to, prescription drug diversion.

Examination of IUPS-specific characteristics also has implications for action. For example, the finding that friends are the primary source of prescription stimulant lending should serve as a call to action to prescribers and pharmacists. Specifically, prescribers and pharmacists who are not doing so presently should be encouraged to discuss both the legal and health-related ramifications that come with sharing prescription drugs (DeSantis et al., 2009; Arria and DuPont, 2010).

A number of future research implications exist. Given the temporal ordering hypothesized by the TTI, future research using this dataset could employ structural equation modeling to test more complete/comprehensive models of IUPS. To address gaps related to the lack of longitudinal, geographically diverse studies (Bavarian et al., 2012), researchers could use updated versions of the BEACH-Q to engage in longitudinal studies on nationally representative samples. Lastly, prevention efforts must be created that are theory-guided, tested for effectiveness, disseminated and translated into best practices.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of illicit use of prescription stimulants among students who have engaged in the behavior during college (N = 133)

Variables	Percentage Breakdown[a]
Initiation	
Elementary School	0.8%
Middle School	3.2%
High School	24.4%
College	70.6%
Routes of Ingestion	
Mouth/Swallow	93.7%
Nose/Snort	20.8%
Veins/Inject	0.0%
Other[b]	4.4%
Source of Prescription Stimulants	
Myself (Because I have a prescription)	26.4%
Friend	87.1%
Family	11.9%
Acquaintance	30.4%
Internet	0.0%
Other[c]	1.2%
Motives for Use	
To improve focus	78.2%
To make studying more enjoyable	58.0%
To stay awake for a long time	58.6%
To improve concentration	77.1%
To lose weight	11.1%
To party longer	22.5%
To experiment	30.7%
Other[c]	8.4%
Experienced Desired Outcome	
Strongly Disagree	4.7%
Disagree	7.9%
Neutral	19.7%
Agree	47.2%
Strongly Agree	20.5%

[a] For routes, sources, and motives, students engaging in misuse were asked to check all that apply

[b] Example responses for “other” routes included “Crush up and eat”, “dissolve in alcohol and drink” and “smoke”

[c] One student listed “my doctor” as a source

[d] Example responses for “other” motives included “To feel good”, “to get high” and to increase strength of painkiller”

Table 2

Nested Logistic Regression Analyses including four levels of causation for the Intrapersonal Stream of Influence (N = 467 students)

Variables	Model 1 Ultimate Adjusted OR (95% CI)	Model 2 Ultimate + Distal Adjusted OR (95% CI)	Model 3 Ultimate + Distal + Proximal Adjusted OR (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Adjusted OR (95% CI)
Intrapersonal Stream				
Ultimate Underlying Causes				
Inattention[a]	1.47 (1.05, 2.07) *	1.07 (0.73, 1.58)	0.95 (0.59, 1.53)	0.98 (0.56, 1.70)
Hyperactivity[a]	1.66 (1.08, 2.54) *	1.50 (0.96, 2.33)	1.35 (0.79, 2.32)	1.06 (0.56, 2.00)
Sensation-Seeking[a]	1.75 (1.30, 2.37) **	1.89 (1.38, 2.58) **	1.17 (0.79, 1.72)	0.76 (0.48, 1.22)
Gender				
Female	1.00	1.00	1.00	1.00
Male	0.84 (0.52, 1.36)	0.90 (0.54, 1.48)	1.51 (0.80, 2.84)	1.74 (0.84, 3.60)
Race/Ethnicity				
White	1.00	1.00	1.00	1.00
Asian or Pacific Islander	0.20 (0.04, 0.88) *	0.17 (0.04, 0.80) *	0.13 (0.02, 0.72) *	0.08 (0.01, 0.50) **
Other	0.86 (0.42, 1.76)	0.79 (0.38, 1.63)	0.90 (0.37, 2.20)	1.12 (0.42, 2.96)
Age	0.95 (0.87, 1.04)	0.95 (0.86, 1.04)	0.95 (0.85, 1.05)	0.98 (0.89, 1.09)
Year in School				
1st year	1.00	1.00	1.00	1.00
2nd year	2.05 (0.72, 5.85)	1.81 (0.60, 5.49)	1.92 (0.51, 7.14)	1.23 (0.27, 5.51)
3rd year	3.56 (1.25, 10.12) *	3.81 (1.26, 11.50) *	2.93 (0.78, 11.07)	2.04 (0.45, 9.22)
4th year	5.68 (2.01, 15.99) **	5.74 (1.91, 17.27) **	4.13 (1.07, 15.87) *	2.76 (0.61, 12.58)
5th year or postbac	5.25 (1.63, 16.89) **	4.88 (1.42, 16.76) *	3.34 (0.75, 14.83)	3.33 (0.64, 17.40)
International Student Status				
Domestic	1.00	1.00	1.00	1.00
International	1.00 (0.24, 4.16)	0.63 (0.13, 3.09)	0.36 (0.06, 2.22)	0.86 (0.14, 5.14)
Enrollment Credits	0.94 (0.83, 1.06)	0.95 (0.84, 1.07)	0.89 (0.76, 1.05)	0.91 (0.76, 1.09)
Distal Predisposing Influences				
Psychological Distress[b]		1.18 (0.81, 1.72)	0.82 (0.51, 1.32)	0.84 (0.49, 1.44)
Academic Concern[b]		1.37 (0.93, 2.02)	1.74 (1.04, 2.91) *	1.38 (0.78, 2.44)
Grades				
A		1.00	1.00	1.00
B		2.28 (1.15, 4.53) *	3.69 (1.51, 9.01) **	3.26 (1.15, 9.26) *
C		3.88 (1.54, 9.78) **	6.71 (2.12, 21.25) **	8.65 (2.35, 31.90) **
ADHD Diagnosis				
Never Diagnosed		1.00	1.00	1.00
Ever Diagnosed		1.86 (0.89, 3.89)	2.48 (1.03, 5.99) *	3.27 (1.21, 8.82) *

Variables	Model 1 Ultimate Adjusted OR (95% CI)	Model 2 Ultimate + Distal Adjusted OR (95% CI)	Model 3 Ultimate + Distal + Proximal Adjusted OR (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Adjusted OR (95% CI)
Proximal Immediate Predictors				
Avoidance Self-Efficacy[c]			0.20 (0.14, 0.28) **	0.37 (0.25, 0.55) **
Immediate Precursors				
IUPS Intentions[d]				6.31 (3.61, 11. 01) **

[a] Response options for items in composite measure range from 1 = Strongly Disagree to 5 = Strongly Agree

[b] Response options for items in composite measure range from 1 = None of the time to 5 = All of the time

[c] Response options for items in composite measure range from 1 = Not at all confident to 5 = Completely confident

[d] Response options range from 1 = Very Unlikely to 4 = Very Likely

* $p<0.05$

** $p<0.01$

Table 3

Nested Logistic Regression Analyses including four levels of causation for the Social Situation/Context Stream of Influence (N = 476 students)

Variables	Model 1 Ultimate Adjusted OR (95% CI)	Model 2 Ultimate + Distal Adjusted OR (95% CI)	Model 3 Ultimate + Distal + Proximal Adjusted OR (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Adjusted OR (95% CI)
Social Situation/Context				
Ultimate Underlying Causes				
Residence				
Off-Campus Housing	1.00	1.00	1.00	1.00
Campus Housing	0.23 (0.10, 0.51) **	0.25 (0.09, 0.65) **	0.24 (0.09, 0.65) **	0.21 (0.07, 0.68) **
Distal Predisposing Influences				
Greek Life				
Non-member		1.00	1.00	1.00
Member		0.84 (0.42, 1.66)	0.75 (0.36, 1.54)	0.75 (0.32, 1.77)
Varsity Sports				
Non-member		1.00	1.00	1.00
Member		2.22 (1.08, 4.58) *	2.22 (1.07, 4.64) *	2.82 (1.25, 6.39) *
Relationship Status				
Not in a relationship		1.00	1.00	1.00
In a relationship and NOT living together		1.29 (0.72, 2.31)	1.30 (0.72, 2.36)	1.42 (0.70, 2.87)
In a relationship and living together		0.97 (0.41, 2.28)	0.84 (0.35, 2.04)	1.09 (0.39, 3.06)
Strength of Relationships [a]				
Friends		0.98 (0.67, 1.45)	1.04 (0.70, 1.55)	0.92 (0.57, 1.47)
Family		1.00 (0.72, 1.39)	0.98 (0.70, 1.37)	1.18 (0.78, 1.81)
Faculty/Staff		0.82 (0.60, 1.12)	0.77 (0.56, 1.05)	0.89 (0.61, 1.29)
Perceptions of IUPS by Socializing Agents [b]				
Friends		1.86 (1.20, 2.88) **	1.70 (1.09, 2.64) **	1.30 (0.78, 2.16)
Family		2.05 (1.33, 3.17) **	2.07 (1.33, 3.24) **	2.10 (1.24, 3.54) **
Faculty/Staff		0.66 (0.45, 0.95) *	0.61 (0.41, 0.90) *	0.63 (0.39, 0.99) *
Endorsement of IUPS by Socializing Agents [c]				
Friends		3.00 (2.12, 4.25) **	2.07 (1.40, 3.07) **	1.16 (0.74, 1.84)
Family		1.34 (0.64, 2.83)	1.23 (0.58, 2.58)	0.59 (0.25, 1.37)
Faculty/Staff		0.94 (0.42, 2.10)	1.31 (0.57, 3.00)	2.59 (0.99, 6.79)
Proximal Immediate Predictors				
Behavioral Norms				
Friends IUPS			1.03 (1.01, 1.05) **	1.02 (1.00, 1.04) *

Variables	Model 1 Ultimate Adjusted OR (95% CI)	Model 2 Ultimate + Distal Adjusted OR (95% CI)	Model 3 Ultimate + Distal + Proximal Adjusted OR (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Adjusted OR (95% CI)
Campus IUPS			1.00 (0.98, 1.01)	1.00 (0.98, 1.02)
Immediate Precursors				
IUPS Intentions[d]				6.47 (3.96, 10.56)**

[a] Response options for items range from 1 = Very Weak to 5 = Very strong

[b] Response options for items range from 1 = Very Negatively to 5 = Very Positively

[c] Response options range from 1 = None to 5 = All

[d] Responses options range from 1 = Very Unlikely to 4 = Very Likely

* $p<0.05$

** $p<0.01$

Table 4

Nested Logistic Regression Analyses including four levels of causation for the Sociocultural Environment Stream of Influence (N = 484 students)1

Variables	Model 1 Ultimate Adjusted OR (95% CI)	Model 2 Ultimate + Distal Adjusted OR (95% CI)	Model 3 Ultimate + Distal + Proximal Adjusted OR (95% CI)	Model 4 Ultimate + Distal + Proximal + Immediate Precursor Adjusted OR (95% CI)
Sociocultural Environment				
Ultimate Underlying Causes				
Financial-Related Stress[a]	1.22 (1.02, 1.47) *	1.17 (0.95, 1.45)	1.24 (1.00, 1.53)	1.22 (0.95, 1.56)
Participation in Religious Activities[a]	0.67 (0.55, 0.81) **	0.73 (0.58, 0.90) **	0.75 (0.60, 0.95) *	0.86 (0.66, 1.13)
Exposure to Prescription Drug Media on Television[b]	1.45 (1.05, 2.01) *	1.45 (1.00, 2.12) *	1.43 (0.96, 2.12)	1.52 (0.95, 2.42)
Exposure to Rx Drug Print Media[b]	0.62 (0.44, 0.85) **	0.59 (0.40, 0.86) **	0.62 (0.41, 0.92) *	0.55 (0.34, 0.89) *
Campus Culture – Perception of Academic Demand #1[b]	1.36 (1.00, 1.84)	1.21 (0.85, 1.72)	1.15 (0.81, 1.64)	0.89 (0.59, 1.34)
Campus Culture – Perception of Academic Demand #2[b]	0.89 (0.69, 1.14)	0.87 (0.65, 1.17)	0.88 (0.64, 1.21)	0.88 (0.60, 1.29)
Campus Culture – Perception of Substance Use During College[b]	1.23 (0.96, 1.57)	1.15 (0.86, 1.53)	1.07 (0.80, 1.44)	0.97 (0.68, 1.36)
Campus Culture – Perception of HC Providers Prescription Writing[b]	1.17 (0.93, 1.47)	1.12 (0.87, 1.44)	1.11 (0.85, 1.44)	1.15 (0.84, 1.59)
Distal Predisposing Influences				
Interactions with Social Institutions[b]		0.99 (0.74, 1.31)	0.99 (0.73, 1.33)	1.05 (0.74, 1.51)
Interactions with Social Institutions Influencing Values[b]		0.73 (0.47, 1.12)	0.69 (0.44, 1.08)	0.63 (0.38, 1.07)
Information[b]		1.06 (0.67, 1.68)	0.93(0.58, 1.50)	0.89 (0.51, 1.54)
Information Influencing Knowledge[b]		1.08 (0.68, 1.70)	1.04 (0.65, 1.66)	1.25 (0.72, 217)
IUPS Expectancies[a]				
Positive Expectancies		3.41 (2.51, 4.65) **	2.50 (1.75, 3.56) **	1.48 (0.98, 2.24)
Negative Expectancies		0.63 (0.47, 0.83) **	0.68 (0.50, 0.92) **	0.82 (0.57, 1.16)
Proximal Immediate Predictors				
Knowledge about Prescription Stimulants[b]			1.55 (1.14, 2.10) **	1.58 (1.11, 2.27) *
Attitudes Towards Prescription Stimulants[b]			2.60 (1.53, 4.44) **	1.88 (1.00, 3.52) *
Immediate Precursors				
IUPS Intentions[c]				5.70 (3.73, 8.70) **

[a]Response options for items in composite range from 1 = None of the time to 5 = All of the time

[b]Response options for items in composite range from 1 = Strongly Agree to 5 = Strongly Disagree

[c] Response options for items range from 1 = Very Unlikely to 4 = Very Likely

[*] $p<0.05$

[**] $p<0.01$