An Exploratory Multilevel Analysis of Non-Prescription Stimulant Use in a Sample of College Students

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ABSTRACT

Non-prescription stimulant use is a high-risk behavior prevalent in the college population. To date, research on this substance use behavior lacks a comprehensive theoretical lens, as well as geographical diversity. Guided by the Theory of Triadic Influence (TTI), multilevel (i.e. students within schools) modeling was used to analyze survey data from the Spring 2009 American College Health Association-National College Health Assessment II (ACHA-NCHA II). We hypothesized that the behavior would be associated with ultimate underlying causes, distal predisposing influences, proximal immediate predictors, and immediate precursors found in the TTI's three streams of influence (i.e., intrapersonal, social situation/context, and sociocultural environment). In our sample (N = 10,220 students; 18 schools), the mean prevalence of past-year use of prescription stimulants without a prescription was 10.70% (range: 0.33%-20.04%). Our hypothesis regarding the multifaceted nature of the predictors of the behavior was supported. Implications for prevention efforts, limitations, and future research directions are discussed.

KEYWORDS: Non-Prescription Stimulant Use; College Students; Quantitative Methods, Hierarchical Modeling

BACKGROUND

The adolescent-to-young adult transition can mark a period of increased exposure to various types of substances that can be misused, including prescription stimulants (e.g. amphetamines such as Adderall©, dextroamphetamines such as Dexedrine©, and methylphenidates such as Ritalin©). In one longitudinal study, prevalence of non-prescription stimulant use increased 319% from pre-college to the students' second year, with one in five students having engaged in the behavior (Arria et al., 2008a). Results from the College Alcohol Study, which included 119 campuses, showed past-year prevalence of self-reported nonmedical use of Ritalin©, Dexedrine©, and/or Adderall© ranged from 0% to 25% (McCabe, Knight, Teter, & Wechsler, 2005). In addition, the prevalence of non-prescription use in a single-campus study looking specifically at a high-risk social group (i.e. fraternity members) was 55% (DeSantis, Noar, & Webb, 2009).

The high prevalence of non-prescription stimulant use [NPSU] in the college population may be due, in part, to the academic motives reported by users (Bavarian, Flay, Ketcham, & Smit, 2012). One study conducted on a random sample of 4,580 college students found the top three motives for use were to help with concentration, studying and alertness (Teter, McCabe, LaGrange, Cranford, & Boyd, 2006). These motives have been replicated in multiple studies (e.g., Judson & Langdon, 2009; Low & Gendaszek, 2002). Moreover, motives for NPSU differ from motives to engage in other forms of substance use, such as alcohol, which is used predominately for social and enhancement purposes by youth and young adults (Kuntsche, Knibbe, Gmel, & Engles, 2005), and non-prescription opioid use, which students report engaging in to relieve pain, experiment, and get high (McCabe, Cranford, Boyd, & Teter, 2007). Because the motives for NPSU differ from motives for other forms of substance use, this paper focuses specifically on NPSU.

Although prescription stimulants are used to treat conditions like Attention Deficit Hyperactivity Disorder (ADHD), non-prescription use is cause for concern as it is a particularly high-risk behavior. In addition to their potential for abuse and dependence, prescription stimulants are associated with adverse health effects, including aggression, agitation, hostility, paranoia, suicidal ideation, abdominal cramps,

decreased sleep, dizziness, excessive sweating, high body temperature, irregular heartbeat, cardiovascular failure, and death (National Institute on Drug Abuse, 2009, 2008; Nissen, 2006; White, Becker-Blease, & Grace-Bishop, 2006). Receiving the drug from a peer, as opposed to receiving a prescription from a health care provider, is particularly problematic, as peers may be less aware of the drug recipient's medical allergies, pre-existing conditions and potential for harmful medical interactions (Goldsworthy, Schwartz, & Mayhorn, 2008). Given the prevalence of the behavior and its potential for ill health, research activities that bridge current gaps in the NPSU literature are warranted.

To date, research examining non-prescription stimulant use [NPSU] contains several gaps that should be addressed. One gap is the appreciable lack of theory-based studies. To our knowledge, only one unpublished (Srnick, 2007) and three published (Ford, 2009; Ford & Schroeder, 2009; Judson & Langdon, 2009) studies have used theory to examine NPSU. While the theories examined in these studies (i.e. social learning theory, bond theory, strain theory, and the theory of planned behavior, respectively) have their own merit, use of a theory with an ecological framework would facilitate a comprehensive (intrapersonal, interpersonal, and environmental) understanding of NPSU. A second gap is the lack of geographical diversity in the NPSU literature. The College Alcohol Study referenced above was conducted in 2001, and the majority of studies since then have involved participants from one state and/or university, which limits the external validity (i.e. generalizability) of study findings. The purpose of this study is to provide a comprehensive theoretical lens to NPSU using data from a geographically diverse sample of undergraduate college students.

Guided by the Theory of Triadic Influence (TTI; Flay, Snyder, & Petraitis, 2009; Flay & Petraitis, 1994), we performed an exploratory multilevel analysis on data from the American College Health Association-National College Health Assessment II (ACHA-NCHA II). We aimed to examine associations between past-year non-prescription stimulant use and theoretically-based, hypothesized correlates of NPSU in a large, geographically diverse, sample of college students. We hypothesized that NPSU among college students is multi-etiological, having significant associations with intrapersonal and broader social and environmental factors (specific hypotheses are discussed below). The goal is to

provide a foundational study upon which future research directions can be discussed and implications for prevention can be suggested.

METHODS

STUDY POPULATION

The spring 2009 ACHA-NCHA II Reference Group consisted of students who completed surveys at colleges and universities that surveyed all students, or used a random sampling approach (ACHA, 2010). Data used in the present study were from students completing paper-based responses (n=11,269; response rate=82%). We excluded the "transgender" category from analyses due to sample size (n=31). As the ACHA-NCHA II is written for an undergraduate student audience, students not identifying as undergraduates were also excluded (n=957). Lastly, students who identified as neither full-time nor part-time were excluded from analyses (n=61). Thus, the final sample size for the present study was 10,220 students from 18 geographically diverse universities.

DATASET AND DATA COLLECTION PROCEDURES

Secondary data analysis was performed on the ACHA-NCHA II, a tool with demonstrated reliability and validity used by colleges and universities to collect, analyze, and interpret data on multiple health-related exposures and outcomes. Schools self-selected to participate in the survey and chose to distribute paper and/or web-based surveys. Data used in the present study were from the spring 2009 ACHA-NCHA II Reference Group. Because Reference Group data are de-identified, the study was deemed exempt from Oregon State University's Institutional Review Board.

THEORETICAL FRAMEWORK AND MEASURES

THE THEORY OF TRIADIC INFLUENCE

The theoretical framework organizing this exploratory analysis is the Theory of Triadic Influence, which includes three streams of influence (i.e. intrapersonal, social situation/context, and sociocultural environment) and four levels of causation (i.e. ultimate causes, distal influences, proximal predictors and immediate precursors) (Flay et al., 2009; Flay & Petraitis, 1994). Although a multitude of meritorious health behavior and criminological theories exist, the TTI was selected based on its ability to unify

various theories into a single framework (Flay et al., 2009). Specifically, the TTI allows for inclusion of constructs from theories including, but not limited to, the theory of planned behavior (Ajzen, 1985), social cognitive theory (Bandura, 1986), personality theory (Zuckerman, 1971), self-control theory (e.g., Gottfredson & Hirschi, 1990), and expectancy theory (e.g., Feather, 1982; as cited in Flay et al., 2009). While individual studies of NPSU have examined different constructs embedded in the TTI, to date, no NPSU studies have analyzed geographically diverse data in accordance with the complete theory.

The TTI's intrapersonal stream of influence focuses on characteristics of one's biology, personality, and demography that ultimately influence feelings of self-efficacy (Bandura, 1977) and behavioral control (Ajzen, 1988) toward a health behavior (Flay et al., 2009). Ultimate underlying causes of NPSU refer to traits beyond the student's control that may promote NPSU, or make the student vulnerable to the physiological effects of prescription stimulants. Distal predisposing influences in the intrapersonal stream refer to affective states and behavioral skills that strengthen the student's internal motivation for NPSU and weaken refusal skills. Proximal immediate predictors in the intrapersonal stream refer to the student's confidence in his/her ability to access, use, or avoid prescription stimulants.

The TTI's social situation/context or interpersonal stream of influence represents characteristics in an individual's immediate social setting(s) that contribute to social normative beliefs (Ajzen & Fishbein, 1980) regarding a health behavior (Flay et al., 2009). With respect to NPSU in the college population, ultimate underlying causes in the social situation/context stream refer to characteristics of the student's social circle that are beyond his/her control yet increase his/her risk of NPSU by influencing perceptions of use (Flay et al., 2009; Petraitis, Flay, Miller, Torpy, & Breiner, 1998). Distal predisposing influences in the social situation/context stream refer to the student's emotional attachments and attitudes towards, and behavior of, NPSU by influential role models. Proximal immediate predictors in the social situation/context stream refer to the student's social normative beliefs regarding NPSU.

The TTI's sociocultural environment stream of influence represents macro-level factors that contribute to a behavior by influencing attitudes towards that behavior (Fishbein & Ajzen, 1975; Flay et al., 2009). With respect to NPSU in the college population, ultimate underlying causes in the sociocultural

environment stream refer to characteristics of the student's campus culture and broader environment that are beyond his/her control yet, nonetheless, increase the student's risk of developing positive attitudes towards prescription stimulants. Distal predisposing influences in this stream refer to the nature of the student's interactions with his/her environment as well as the outcomes the student expects will come from NPSU that promote positive attitudes toward NPSU (Flay et al., 2009; Petraitis et al., 1998). Proximal immediate predictors in the sociocultural environment stream refer to the student's attitudes towards NPSU.

At the distal level, the combination of self-efficacy, social normative beliefs, and attitudes toward a behavior influence a person's intent and decision to perform a behavior (Ajzen, 1985; Flay et al., 2009). Furthermore, according to the TTI, the experiences gained from trial behavior influence not only related behaviors (and vice versa), but also the decision to continue the behavior. Immediate precursors therefore include behavioral intentions, trial behavior and experiences, and engaging in related behavior.

INTRAPERSONAL STREAM OF INFLUENCE COVARIATES

Ultimate-level intrapersonal constructs asked in the ACHA-NCHA II, and examined for association with NPSU, included *gender*, *ethnicity*, *age*, *year in school* (1st year undergraduate to 5th year undergraduate or more), and *enrollment status* (full-time or part-time). We hypothesized that NPSU would be associated with being male (e.g., DeSantis, Webb, & Noar, 2008; Low & Gendaszek, 2002; McCabe et al., 2005), identifying as White (e.g., DeSantis et al., 2008; DuPont, Coleman, Bucher, & Wilford, 2008; Tuttle, Scheurich, & Ranseen, 2010), being older than 18 and an upperclassmen (e.g., Babcock & Byrne, 2000; DeSantis et al., 2009; DeSantis et al., 2008), and we speculated that full-time students would be more likely to engage in NPSU as compared to part-time students, given the academic motives for NPSU and the fact that full-time students are enrolled in more courses than part-time students. Distal constructs asked in the ACHA-NCHA II include *depression diagnoses*(ever versus never diagnosed), *academic stress* (no stress versus stress), and *grade point average* ("A", "B", "C", "D/F", "Not applicable"). We hypothesized that students experiencing psychological distress, as measured by a diagnosis of depression and self-reported academic stress, would have a higher odds of engaging in NPSU

than students without these indicators of distress (e.g, Herman-Stahl, Krebs, Kroutil, & Heller, 2007; Teter et al., 2006; Weyandt et al., 2009; Wu, Pilowsky, Schlenger,& Galvin, 2007). In addition, we hypothesized that students with an "A" grade point average would be less likely to engage in NPSU as compared to students with lower grade point averages (e.g., McCabe et al., 2005; Shillington, Reed, Lange, Clapp, & Henry, 2006). No item in the ACHA-NCHA II directly asks students about self-efficacy or behavioral control beliefs.

SOCIAL SITUATION/CONTEXT STREAM OF INFLUENCE COVARIATES

Greek housing (recoded as binary), which refers to living in a fraternity or sorority house, is a college-specific social situation that was examined for its association with NPSU. We hypothesized that students living in a fraternity or sorority would have a higher odd of engaging in NPSU as compared to students not living in this setting (McCabe, Teter, & Boyd, 2006; Shillington et al., 2006). With respect to distal influences, concepts of interpersonal bonding and motivation to comply suggest the importance of examining college-specific sub-cultures. Accordingly, we examined the association between NPSU and participation in *Greek life* and *varsity sports*, and hypothesized that Greek participants (e.g., DeSantis et al., 2008; McCabe et al., 2005; Shillington et al., 2006) and student-athletes (e.g., Ford, 2008) would have a higher odd of engaging in NPSU than their non-Greek and non-student-athlete counterparts, respectively. Additionally, as romantic partners have been identified as a common source of prescription stimulants (DeSantis et al., 2008; DuPont et al., 2008; McCabe & Boyd, 2005), *relationship status* (single versus not single) was examined; because we also speculated that students in a relationship would have greater time demands, our hypothesis was that students in a relationship would have a higher odd of engaging in NPSU than single students. Perceptions of prevalence of use by others would provide an understanding of behavioral norms, yet the ACHA-NCHA II does not ask students about their perceptions of the prevalence of NPSU by fellow students.

SOCIOCULTURAL ENVIRONMENT STREAM OF INFLUENCE COVARIATES

Ultimate-level sociocultural constructs captured by the ACHA-NCHA II were socioeconomic status (using *financial stress* as a proxy) and school-level characteristics such as *public* vs. private school,

r*eligious* vs. non-religious campus, *four-year* vs. two-year institution, *campus size* (categorical; 1 = less than 2,500, 2 = 2,500-4,999, 3 = 5,000-9,999, 4 = 10,000-19,999, 5 = 20,000 or more students), and *campus region* (categorical; 1 = West, 2 = Northeast, 3 = Midwest, 4 = South). In accordance with the NPSU literature, we hypothesized that students without financial stress would be more likely to engage in NPSU than students reporting financial stress (Teter, McCabe, Boyd, & Guthrie, 2003; White et al., 2006). Schools serve as a key socializing agent, and as colleges and universities vary on a number of characteristics, we argue it is important to determine if any of these characteristics are associated with NPSU. As prior research has shown that NPSU is greater at colleges with more competitive admissions standards (McCabe et al., 2005), we hypothesized that NPSU would be greater amongst students attending four-year versus two-year schools. In addition, religiosity has been shown to buffer the effects of substance use on adolescents (Willis, Yaeger, & Sandy, 2003); for this reason, we hypothesized that students attending non-religious schools would be more likely to engage in NPSU as compared to students attending religious schools. We hypothesized that NPSU would be more likely at larger schools, as we speculated that smaller school size would be associated with greater school engagement (Weiss, Carolan, Baker-Smith, 2010). We also hypothesized that NPSU would vary by region, as prior research examining other forms of prescription drug availability has shown geographic variation (Curtis et al., 2006). Lastly, we hypothesized public and private universities would differ in the likelihood of having students engage in NPSU, as health risk behaviors have been shown to vary between students attending public and private schools at the high-school level (Valois, Tatcher, Drane, & Reininger, 1997). No ACHA-NCHA II items capture distal-level constructs such as interactions with health care providers, faculty and students, and NPSU expectancies. Also, student attitudes toward NPSU (a proximal influence) were not measured in the ACHA-NCHA II.

IMMEDIATE PRECURSORS

We examined past-30 day ever use of *alcohol*, *cigarettes*, *marijuana*, and *cocaine*. We hypothesized that students who engaged in these other forms of substance use would be more likely to

engage in NPSU (Barrett, Darredeau, Bordy, & Pihl, 2005; Kaloyanides, McCabe, Cranford, & Teter, 2007; McCabe & Teter, 2007; Teter, McCabe, Cranford, Boyd, & Guthrie, 2005).

BEHAVIOR

Non-prescription stimulant use, our dependent variable, was examined using the following item: "Within the last 12 months, have you taken any of the following prescription drugs that were not prescribed to you? [Stimulants (e.g., Ritalin, Adderall)]". Response options were binary in nature (e.g., No/Yes).

ANALYTIC STRATEGY

Statistical analyses were completed using Stata v12.1 given the software's ability to estimate multilevel logistic regression models. Sample characteristics, overall and stratified by NPSU status, were expressed as percentages within each group; Chi-square *p* values were calculated to examine differences in proportions between the NPSU and no-NPSU groups.

Because the study included 18 clusters (i.e. 18 colleges and universities) and our dependent variable was binary in nature, we used the median odds ratio (MOR) as our index of clustering (Hox, 2010; Larsen & Merlo, 2005; Merlo et al., 2006). The MOR can be conceptualized as the increase in risk of NPSU that a student would have if the student transferred to a school with a higher likelihood of NPSU and all covariates were held constant (Schootman, Jeff, Billanders, Yan, Jenkins, & Aft, 2007; Larsen & Merlo, 2005). An MOR of 1.00 would indicate that there is no variation between schools, whereas an MOR greater than 1.00 would reflect heterogeneity, and thus the need to include school as a random effect in a multilevel logistic analysis (Larsen & Merlo, 2005); preliminary analysis confirmed the need to include school as a random effect (i.e. our null model for NPSU had an MOR of 3.02).

Using Stata's "xtmelogit" function for multilevel logistic regression (Rabe-Hesketh & Skrondal, 2008), a generalized multilevel model estimated the adjusted odds ratios (ORs) of NPSU for the aforementioned TTI-based covariates (fixed effects) by stream of influence, including school as the random effect. Data were not missing at the school level, and these models were completed using maximum likelihood estimation.

In our multilevel analyses, we estimated sequential models per stream of influence. Model 1 for each of the three streams was the null model containing only the dependent variable (i.e. NPSU) and the random effect of school. Model 2 included ultimate-level variables, and the random effect of school. Model 3 included ultimate- and distal-level (when applicable) variables, and the random effect of school. The next model would have included ultimate-, distal-, and proximal-level variables, however, the ACHA-NCHA II did not include proximal-level predictors of NPSU. As such, the final, full model included ultimate, distal (when applicable), and immediate precursors, and the random effect of school; the latter model was used to determine the adjusted odds of engaging in NPSU for each of the TTI-based covariates. The MOR was also calculated for each sequential model.

RESULTS

Table 1, organized via the TTI's theoretical framework, shows descriptive characteristics of the sample. Respondents were mainly female (56.52%), identified as White, non Hispanic (72.92%), under the age of 23 (85.59%), and were enrolled full-time (94.21%). Although a majority of respondents reported an "A" or "B" grade point average (78.29%), over 40% of respondents reported experiencing academic stress in the past 12 months.

The mean prevalence of past-year NPSU across the 18 schools wa 10.70% (range: 0.33%-20.04%). Chi-square analyses (Table 1) showed NPSU was more likely among students with certain intrapersonal (e.g., male as compared to female), social (e.g., Greek participant as compared to non participant), and environmental (non-religious school attendee versus religious school attendee) characteristics.

----TABLE 1 ABOUT HERE----

In the intrapersonal stream's full multilevel logistic regression model (Table 2), identifying as White, past year depression diagnosis, experiencing academic stress in the past 12 months, lower grade point average, and engaging in other forms of substance use were associated with NPSU. For example, the odds of NPSU was 1.64 times higher ($p<0.01$) among White students compared to non-White students. Students with a past year depression diagnosis were 1.56 times more likely to engage in NPSU

($p<0.01$), compared to students with no past year depression diagnosis. As compared to students who did not report experiencing academic stress in the past 12 months, the odds of NPSU was 1.41 times higher in students who experienced academic stress ($p<0.01$). As compared to students with an "A" grade average, students who had a "B" average, "C" average, or who did not yet establish a grade average, were more likely to engage in NPSU ($p<0.01$).

----TABLE 2 ABOUT HERE----

Social situation stream covariates significantly associated with NPSU (Table 3) included residing in Greek housing and participating in Greek life. In addition, the substance use precursors remained significantly associated with the behavior in the full model. As compared to students who did not live in Greek housing, students living in Greek housing were 1.41 times more likely to engage in NPSU ($p<0.05$). Students participating in Greek life were also more likely to engage in NPSU, compared to students not involved in fraternities or sororities (OR = 1.66, $p<0.01$).

----TABLE 3 ABOUT HERE----

With respect to the sociocultural environment stream of influence (Table 4), in the full model, experiencing financial stress, attending a non-religious (as opposed to a religious) university and campus region were associated with NPSU. For example, students experiencing financial stress were 1.21 times ($p<0.05$) more likely to engage in NPSU, compared to students reporting no financial stress. NPSU was less likely amongst students attending religious schools, compared to students attending religious schools (OR = 0.04, $p<0.05$). With respect to campus region, NPSU was 2.68 times more likely amongst students attending schools in the South ($p<0.05$), compared to students attending schools in the West. Similar to the intrapersonal and interpersonal streams of influence, engaging in other types of substance use was also significantly associated with NPSU in the full sociocultural environment stream model.

----TABLE 4 ABOUT HERE----

Tables 2 through 4 also provide information on the effect each of the consecutive models had on the MOR. For all three streams of influence, the size of the MOR decreased from the null model (MOR =

3.02) to the full model. The biggest decrease was seen in the sociocultural environmental stream (full model MOR = 1.58).

DISCUSSION

We found that NPSU was prevalent on the 18 geographically diverse schools under examination in this study. The 10.70% mean past-year prevalence is greater than the 3.60% reported by Ford and Schroeder (2009) in their secondary analyses of the 2001 Harvard College Alcohol Study, and the 5% reported by Lord and colleagues (2009) in their single-campus study. The prevalence, however, is similar to those reported by Arria and colleagues (2008c) and Shillington and colleagues (2006). The finding that 1 in 10 students had engaged in NPSU in the past-year is cause for concern, given the health effects associated with even legitimate prescription stimulant use.

Findings from the present study supported the hypothesis that NPSU among college students has significant associations with ultimate underlying causes, distal predisposing influences, and immediate precursors found in the TTI's three streams of influences (we could not examine associations with proximal predictors). Significant intrapersonal stream covariates included identifying as White (ultimate cause), receiving a past year depression diagnosis (distal influence), experiencing academic stress in the past 12 months (distal influence), and grade point average (distal influence). Significant social situation stream covariates included residing in Greek housing (ultimate cause) and participating in Greek life (distal influence). With respect to the sociocultural environment stream, NPSU was associated with socioeconomic status (ultimate cause), attending a non-religious university (ultimate cause), and campus region (ultimate cause). Lastly, engaging in related behaviors (i.e. use of alcohol, cigarettes, marijuana, and cocaine) were significant immediate precursors associated with NPSU.

Covariates in the intrapersonal stream of influence found to be associated with NPSU compare and contrast with findings from prior studies. With respect to ultimate level factors, the finding that students identifying as White were more likely to engage in NPSU replicated past studies (DeSantis et al., 2008; DuPont et al., 2008; Rabiner et al., 2009; Herman-Stahl et al., 2007; Teter et al., 2006; McCabe et al., 2005). Although NPSU has been reported as more likely in males (DeSantis et al., 2008; Rabiner et

al., 2009; Hall, Irwin, Bowman, Frankenberger, & Jewett, 2005; McCabe et al., 2005; Low & Gendaszek, 2002), this finding was not replicated in our full model. When controlling for substance use behaviors, our finding that males *and* females were equally engaging in NPSU may reflect that students, in general, perceive prescription stimulants as safer, more socially acceptable, and stigma-free (DeSantis et al., 2008; Cicero, Inciardi, & Muñoz, 2005). These results suggest that health care providers should be aware that the risk for NPSU exists among the male *and* female populations they serve. Future research should also seek to determine whether the non-academic motives for NPSU may differ between men (e.g., to exacerbate the effects of alcohol) and women (e.g., to assist in weight-loss efforts).

With respect to the distal level of causation in the intrapersonal stream, higher levels of psychological distress have been associated with NPSU (Weyandt et al., 2009; Herman-Stahl et al., 2007). In our study, students with a diagnosis of depression and academic stress, arguably two types of psychological distress, were also found to be more likely to engage in NPSU. These findings have implications for student affairs (e.g., academic advisors) and student health professionals (e.g. psychologists), who are already trained to identify students experiencing the respective forms of stress, (e.g., briefly screen students presenting with distress for NPSU).

Findings on covariates in the social situation stream also compare and contrast with past research. Our study findings paralleled past studies that have demonstrated a greater prevalence of NPSU amongst students involved in Greek life (Weyandt et al., 2009; DeSantis et al., 2008; McCabe 2008; Rabiner et al., 2009; Shillington et al., 2006; McCabe et al., 2005), and also added to the research by showing that students residing in Greek housing were more likely to engage in NPSU. These results highlight the importance of targeted interventions for the Greek community. Unlike work done by Ford (2008), we did not find an association between NPSU and being a student-athlete, which may reflect the influence of the more strict substance use policies often enforced upon student-athletes. Future research should seek to determine whether this finding holds true when examining other forms of prescription drug misuse, such as non-prescription opioid use.

With respect to ultimate-level covariates in the sociocultural environment stream, other studies have found that students with a higher family income are more likely to engage in NPSU (White et al., 2006; Teter et al., 2003). We found, however, that students reporting financial stress were more likely to engage in NPSU. Students with greater financial stress may have to work while attending school, and, as a result, may have greater time demands than students not reporting financial stress. Results from the sociocultural environment stream also contributed to the relatively limited understanding of the importance of contextual factors (e.g., campus region and religiosity) on NPSU.

Lastly, with respect to immediate precursors, numerous studies have reported that NPSU is more likely among students who report use of alcohol and other drugs (e.g., Advokat, Guidry, & Martino, 2008; Arria et al., 2008a; Rabiner et al., 2009; Herman-Stahl et al., 2007; Kaloyanides et al., 2007; McCabe & Teter, 2007; McCabe et al., 2006; Barrett et al., 2005; McCabe et al., 2005; Teter et al., 2005; Teter et al., 2003); these findings were replicated in our analysis. Accordingly, messages about NPSU should be incorporated into pre-existing substance use prevention programs. In addition, screening policies that promote early assessment and referral could incorporate NPSU into assessments (Arria et al., 2008a; Arria et al., 2008b).

We found that school context was important for understanding an individual student's probability of engaging in NPSU. School level variables (e.g., size, location, type of institution) appeared to have a greater impact on NPSU than individual level variables, as the MOR decrease was greatest in the model for the sociocultural environment stream of influence. Accordingly, examining school level characteristics may serve as a worthwhile starting point for schools interested in determining their students' risk for NPSU.

LIMITATIONS AND FUTURE DIRECTIONS

As with any secondary analysis, limitations of the pre-existing instrument were present. For example, the dependent variable did not provide information on frequency of use, and asked only if students had used prescription stimulants without a prescription. Although the focus of this paper was non-prescription stimulant use, this definition does not include students who use their medication in

excess of what has been prescribed and/or for nonmedical reasons (e.g., to stay awake, to exaggerate the effects of alcohol, etc.). As a result, the true prevalence of the *illicit use* of prescription stimulants in the sample is likely to be greater than the observed prevalence of NPSU. Implications for future research include development of an instrument that assesses the frequency of 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. We were also limited by the response options provided for some measures in the ACHA-NCHA II. For example, certain measures in our analyses that were dichotomous in nature (e.g. academic stress) would have been more informative had they included response options with greater variation. As such, future research directions include development and/or adoption of instruments that include multiple items with Likert-scale response options. In addition, our measure of socioeconomic status was limited to a single-item. Future research could examine whether other indicators of socioeconomic status (e.g., parent education levels, income) have an association with NPSU. Another limitation of the instrument is that it did not include all theoretically-expected correlates of NPSU. Past studies using the TTI to examine risk behaviors have varied with respect to the constructs included in analyses (e.g., Caravajal & Granillo, 2006; Grunbaum, Tortolero, Weller, & Gingiss, 2000; Rohrbach, Sussman, Dent, &Sun, 2005). Although a number of measures used in these studies parallel the measures used in our study (e.g., gender, ethnicity, age, depression, socioeconomic status, religiosity, other substance use, etc.), the TTI posits that constructs such as access self-efficacy, social normative beliefs about NPSU, NPSU expectancies, attitudes towards NPSU, and intentions to engage in NPSU should be associated with the behavior; none of these measures were included in our analyses as they are not asked in the ACHA-NCHA II. Given that the ACHA-NCHA II dataset does not measure every construct embedded within the TTI, a comprehensive model could not be tested, and thus these analyses were exploratory in nature. As such, the need exists for an instrument that encompasses the ultimate causes, distal influences, proximal predictors and immediate precursors not included in the ACHA-NCHA II so that analyses can move from exploratory to testing a comprehensive, theory-driven, model of NPSU. A final limitation of the dataset is that it was cross-sectional. Because cross-sectional studies limit the

ability to determine temporality and make causal inferences, future studies should be longitudinal in nature.

Limitations notwithstanding, this study does have several important strengths. Two gaps in this field of study were addressed in this analysis by using 1) a large, geographically diverse sample and 2) a comprehensive theoretical framework. Recently, Schroeder and Ford (2012) used a geographically diverse data set to examine relationships between adolescent prescription drug misuse (i.e. misuse of pain relievers, tranquilizers, sedatives, or stimulants) and social learning, social bond, and strain theories. In this study, we used one meta-theoretical frame to examine NPSU specifically in a geographically diverse sample of college students. The use of the TTI provided a key foundational step for this field of study and our analysis provided key insights into the multi-etiological nature of college students' NPSU by examining not only intrapersonal correlates of use, but also interpersonal and environmental covariates. As a result, this exploratory study provided insight on the multifaceted nature of NPSU and the need for comprehensive strategies to address the behavior among youth transitioning to young adulthood.

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Table 1. Characteristics of the Sample (N = 10,220 students from 18 colleges and universities), overall and by Non-Prescription Stimulant Use [NPSU] status (American College Health Association-National College Health Assessment II, Spring 2009, Paper Surveys)

Variables	Sample n (%)	NPSU n (%)	No NPSU (n %)	*p<0.05 **p<0.01
Intrapersonal Stream				
Ultimate Underlying Causes				
Gender				**
Female	5,614 (56.52%)	526 (50.00%)	5,046 (57.61%)	
Male	4,318 (43.48%)	526 (50.00%)	3,713 (42.39%)	
Ethnicity [a]				**
White, non Hispanic	7,452 (72.92%)	962 (89.32%)	6,397 (71.14%)	
Black, non Hispanic	1,232 (12.05%)	35 (3.25%)	1,173 (13.04%)	
Hispanic or Latino/a	869 (8.50%)	37 (3.44%)	825 (9.17%)	
Asian or Pacific Islander	378 (3.70%)	27 (2.51%)	341 (3.79%)	
American Indian, Alaska Native, or Native Hawaiian	138 (1.35%)	9 (0.84%)	127 (1.41%)	
Biracial or Multiracial	285 (2.79%)	34 (3.16%)	246 (2.74%)	
Other	205 (2.01%)	22 (2.04%)	179 (1.99%)	
Age (in years)				**
18	1,294 (13.17%)	88 (8.41%)	1,189 (13.72%)	
19	2,376 (24.19%)	246 (23.52%)	2,106 (24.31%)	
20	2,025 (20.61%)	237 (22.66%)	1,763 (20.35%)	
21	1,677 (17.07%)	251 (24.40%)	1,410 (16.27%)	
22	1,036 (10.55%)	122 (11.66%)	905 (10.45%)	
23	385 (3.92%)	42 (4.02%)	340 (3.92%)	
24	172 (1.75%)	20 (1.91%)	150 (1.73%)	
25+	859 (8.74%)	40 (3.82%)	801 (9.25%)	
Year in School				**
1st year undergraduate	3,316 (32.45%)	254 (23.58%)	3,009 (33.46%)	
2nd year undergraduate	2,717 (26.59%)	300 (27.86%)	2,370 (26.36%)	
3rd year undergraduate	2,107 (20.62%)	257 (23.86%)	1,828 (20.33%)	
4th year undergraduate	1,576 (15.42%)	197 (18.29%)	1,353 (15.05%)	
5th year undergraduate or more	504 (4.93%)	69 (6.41%)	432 (4.80%)	
Enrollment Status				
Full Time	9,592 (94.21%)	1,039 (96.83%)	8,430 (94.01%)	
Part Time	590 (5.79%)	34 (3.17%)	537 (5.99%)	
Distal Predisposing Influences				
Received Depression diagnosis in Past 12 months				**
Yes	849 (8.44%)	152 (14.60%)	677 (7.68%)	
No	9,107 (91.56%)	889 (85.40%)	8,141 (92.32%)	
Experienced Academic Stress in Past 12 months				**
Yes	4,015 (40.13%)	571 (53.77%)	3,412 (38.56%)	
No	5,989 (59.87%)	491 (46.23%)	5,473 (61.44%)	
Grade Point Average				**
“A”	2,372 (23.52%)	182 (17.25%)	2,167 (24.38%)	
“B”	5,524 (54.77%)	620 (58.77%)	4,821 (54.25%)	
“C”	1,933 (19.17%)	226 (21.42%)	1,676 (18.86%)	
“D/F”	99 (0.98%)	13 (1.23%)	84 (0.95%)	
“n/a”	157 (1.56%)	14 (1.33%)	139 (1.56%)	
Proximal Immediate Predictors – Not Available				
Social Situation/Context				
Ultimate Underlying Causes				
Greek Housing				**
Yes	314 (3.09%)	87 (8.16%)	223 (2.49%)	
No	9,840 (96.91%)	979 (91.84%)	8,723 (97.51%)	

Variables	Sample n (%)	NPSU n (%)	No NPSU (n %)	*p<0.05 **p<0.01
Distal Predisposing Influences				
Greek Life Participant				**
Yes	1,192 (11.78%)	262 (24.53%)	917 (10.28%)	
No	8,926 (88.22%)	806 (75.47%)	8,004 (89.72%)	
Student Athlete				**
Yes	1,437 (14.50%)	112 (10.72%)	1,301 (14.89%)	
No	8,473 (85.50%)	933 (89.28%)	7,436 (85.11%)	
Student in Romantic Relationship				**
Single	4,853 (47.81%)	565 (52.85%)	4,216 (47.17%)	
Not Single	5,298 (52.19%)	504 (47.15%)	4,722 (52.83%)	
Proximal Immediate Predictors – Not Available				
Sociocultural Environment				
Ultimate Underlying Causes				
Socioeconomic Status Indicator				**
Financial Stress	3,520 (35.28%)	445 (41.98%)	3,040 (34.45%)	
No financial Stress	6,456 (64.72%)	615 (58.02%)	5,785 (65.55%)	
School Characteristics – Public or Private				**
Public	9,800 (95.89%)	1,057 (98.14%)	8,596 (95.60%)	
Private	420 (4.11%)	20 (1.86%)	396 (4.40%)	
School Characteristics – Religious or Non-Religious				**
Religious	170 (1.66%)	1 (0.09%)	166 (1.85%)	
Non-Religious	10,050 (98.34%)	1,076 (99.91%)	8,826 (98.15%)	
School Characteristics – Two-Year or Four-Year				**
Two Year	2,082 (20.37%)	79 (7.34%)	1,962 (21.82%)	
Four Year	8,138 (79.63%)	998 (92.66%)	7,030 (78.18%)	
School Characteristics - Campus Size				**
Less than 2,500 students	1,381 (13.51%)	93 (8.64%)	1,267 (14.09%)	
2,500 – 4,999 students	420 (4.11%)	48 (4.46%)	361 (4.01%)	
5,000 – 9,999 students	1,042 (10.20%)	75 (76.96%)	955 (10.62%)	
10,000 – 19,999 students	4,183 (40.93%)	341 (31.66%)	3,787 (42.12%)	
20,000 or more students	3,194 (31.25%)	520 (48.28%)	2,622 (29.16%)	
School Characteristics – Region				**
West	3,197 (31.28%)	122 (11.33%)	3,023 (33.62%)	
Northeast	250 (2.45%)	19 (1.76%)	230 (2.56%)	
Midwest	3,111 (30.44%)	467 (43.36%)	2,594 (28.85%)	
South	3,662 (35.83%)	469 (43.55%)	3,145 (34.98%)	
Distal Predisposing Influences – Not available				
Proximal Immediate Predictors – Not available				
Immediate Precursors				
Related Behaviors				
Alcohol Use (Past 30 Day Use)				**
Yes	6,564 (64.88%)	1,002 (94.00%)	5,480 (61.46%)	
No	3,553 (35.12%)	64 (6.00%)	3,437 (38.54%)	
Cigarette Use (Past 30 Day Use)				**
Yes	2,138 (21.06%)	557 (52.01%)	1,547 (17.29%)	
No	8,015 (78.94%)	514 (47.99%)	7,401 (82.71%)	
Marijuana Use (Past 30 Day Use)				**
Yes	2,049 (20.24%)	609 (57.29%)	1,411 (15.80%)	
No	8,076 (79.76%)	454 (42.71%)	7,521 (84.20%)	
Cocaine Use (Past 30 Day Use)				**
Yes	166 (1.64%)	88 (8.28%)	72 (0.80%)	
No	9,978 (98.36%)	975 (91.72%)	8,876 (99.20%)	
Behavior				
Past 12 Month NPSU	1,077 (10.70%)			

[a] Cumulative frequency for ethnicity is greater than 100% due to students filling in multiple ethnicities; *p<0.05, **p<0.01

Table 2. Multilevel logistic regression analyses: Intrapersonal Stream of Influence

Variables	Model 1 – Null Model OR (95% CI)	Model 2 – Ultimate OR (95% CI)	Model 3– Ultimate + Distal OR (95% CI)	Model 4 – Ultimate+Distal+ Proximal+Precursors[a] OR (95% CI)
Intrapersonal Stream				
Ultimate Underlying Causes				
Gender				
Female		1.00	1.00	1.00
Male		1.39 (1.21, 1.59)**	1.46 (1.27, 1.69)**	1.12 (0.95, 1.31)
Ethnicity				
Other		1.00	1.00	1.00
White, Non-Hispanic		1.88 (1.51, 2.35)**	2.05 (1.63, 2.59)**	1.64 (1.27, 2.11)**
Age				
18		1.00	1.00	1.00
19		1.16 (0.87, 1.52)	1.11 (0.83, 1.48)	1.13 (0.82, 1.54)
20		1.15 (0.81, 1.63)	1.08 (0.76, 1.55)	1.08 (0.73, 1.60)
21		1.56 (1.06, 2.29)*	1.39 (0.92, 2.08)	1.41 (0.91, 2.19)
22		1.11 (0.72, 1.72)	0.92 (0.59, 1.45)	0.87 (0.54, 1.43)
23		1.05 (0.62, 1.79)	0.85 (0.49, 1.47)	0.70 (0.39, 1.29)
24		1.28 (0.69, 2.37)	1.11 (0.59, 2.09)	0.91 (0.45, 1.86)
25+		0.78 (0.49, 1.27)	0.72 (0.44, 1.19)	0.77 (0.45, 1.33)
Year in School				
1st year undergraduate		1.00	1.00	1.00
2nd year undergraduate		1.17 (0.92, 1.48)	1.15 (0.90, 1.47)	1.15 (0.87, 1.51)
3rd year undergraduate		0.97 (0.71, 1.32)	1.03 (0.75, 1.42)	1.04 (0.73, 1.49)
4th year undergraduate		1.04 (0.73, 1.49)	1.22 (0.84, 1.77)	1.29 (0.86, 1.94)
5th year undergraduate or more		1.40 (0.90, 2.20)	1.44 (0.90, 2.30)	1.33 (0.80, 2.21)
Enrollment Status				
Full Time		1.00	1.00	1.00
Part Time		1.13 (0.77, 1.67)	1.14 (0.77, 1.70)	1.24 (0.81, 1.90)
Distal Predisposing Influences				
Received Depression diagnosis in Past 12 months				
No			1.00	1.00
Yes			1.93 (1.55, 2.39)**	1.56 (1.23, 1.99)**
Experienced Academic Stress in Past 12 months				
No			1.00	1.00
Yes			1.52 (1.32, 1.76)**	1.41 (1.20, 1.65)**
Grade Point Average				
"A"			1.00	1.00
"B"			1.58 (1.31, 1.90)**	1.26 (1.03, 1. 54)*
"C"			1.85 (1.47, 2.33)**	1.37 (1.07, 1.77)*
"D/F"			3.28 (1.62, 6.65)**	1.47 (0.64, 3.38)
"Not Applicable"			3.46 (1.83, 6.54)**	2.89 (1.45, 5.76)**
Proximal Immediate Predictors – Not Available				
Immediate Precursors/ Related Behaviors				
Alcohol Use (Past 30 Days)				
No				1.00
Yes				3.25 (2.42, 4.36)**
Cigarette Use (Past 30 Days)				
No				1.00
Yes				2.28 (1.93, 2.69)**
Marijuana Use (Past 30 Days)				

No				1.00
Yes				3.38 (2.87, 4.00)**
Cocaine Use (Ever vs. Never Used)				
No				1.00
Yes				4.05 (2.70, 6.09)**
Median Odds Ratio [95% CI]	3.02 [2.13, 4.92]	2.62 [1.94, 4.10]	2.62 [1.94, 4.10]	2.25 [1.70, 3.35]

[a]The ACHA-NCHA II does not have a measure of self-efficacy with respect to prescription stimulants (a proximal predictor)
*p<0.05, **p<0.01

Table 3. Multilevel logistic regression analyses: Social situation/context stream of influence

Variables	Model 1 – Null Model OR (95% CI)	Model 2 – Ultimate OR (95% CI)	Model 3 – Ultimate+Distal OR (95% CI)	Model 4 – Ultimate+Distal+ Proximal+Precursor[a] OR (95% CI)
Interpersonal stream				
Ultimate Underlying Causes				
Greek Housing				
No		1.00	1.00	1.00
Yes		2.28 (1.74, 3.00)**	1.45 (1.06, 1.98)*	1.41 (1.00, 1.99)*
Distal Predisposing Influences				
Greek Life Participant				
No			1.00	1.00
Yes			1.86 (1.54, 2.24)**	1.66 (1.35, 2.04)**
Student Athlete				
No			1.00	1.00
Yes			0.99 (0.78, 1.26)	1.19 (0.91, 1.56)
Student in Romantic Relationship				
No			1.00	1.00
Yes			1.18 (1.03, 1.35)*	1.01 (0.87, 1.17)
Proximal Immediate Predictors – Not Available				
Immediate Precursors				
Related Behaviors				
Alcohol Use (Past 30 Days)				
No				1.00
Yes				3.33 (2.51, 4.42)**
Cigarette Use (Past 30 Days)				
No				1.00
Yes				2.45 (2.09, 2.87)**
Marijuana Use (Past 30 Days)				
No				1.00
Yes				3.42 (2.91, 4.02)**
Cocaine Use (Past 30 Days)				
No				1.00
Yes				3.52 (2.41, 5.15)**
Median Odds Ratio [95% CI]	3.02 [2.13, 4.92]	2.97 [2.11, 4.82]	2.83 [2.04, 4.56]	2.39 [1.81, 3.62]

[a]The ACHA-NCHA II does not have a measure of social normative beliefs with respect to prescription stimulants (a proximal predictor)
*p<0.05, **p<0.01

Table 4. Multilevel logistic regression analyses: Sociocultural environment stream of influence

Variables	Model 1 – Null Model OR (95% CI)	Model 2 – Ultimate OR (95% CI)	Model 3 – Ultimate+Distal+ Proximal+Precursor[a] OR (95% CI)
Sociocultural Environment Stream			
Ultimate Underlying Causes			
Socioeconomic Status Indicator			
No financial stress		1.00	1.00
Financial Stress		1.55 (1.35, 1.77)**	1.21 (1.04, 1.40)*
School Characteristics - Public Or Private			
Private		1.00	1.00
Public		0.55 (0.09, 3.56)	0.53 (0.11, 2.43)
School Characteristics – Religious			
Non-Religious		1.00	1.00
Religious		0.02 (0.00, 0.34)**	0.04 (0.00, 0.49)*
School Characteristics – Two-Year or Four-Year			
Two Year		1.00	1.00
Four Year		2.64 (0.83, 8.36)	2.15 (0.83, 5.60)
School Characteristics - Campus Size			
Less than 2,500 students		1.00	1.00
2,500 – 4,999 students		3.04 (0.45, 20.59)	2.40 (0.50, 11.46)
5,000 – 9,999 students		0.27 (0.07, 1.13)	0.46 (0.14, 1.47)
10,000 – 19,999 students		1.04 (0.33, 3.26)	1.28 (0.50, 3.26)
20,000 or more students		1.66 (0.47, 5.93)	2.04 (0.73, 5.74)
School Characteristics – Region			
West		1.00	1.00
Northeast		---[b]	---[b]
Midwest		2.47 (0.92, 6.60)	2.18 (0.98, 4.87)
South		3.40 (1.15, 10.05)*	2.68 (1.12, 6.41)*
Distal Predisposing Influences – Not available			
Proximal Immediate Predictors – Not available			
Immediate Precursors			
Related Behaviors			
Alcohol Use (Past 30 Days)			
No			1.00
Yes			3.45 (2.61, 4.56)**
Cigarette Use (Past 30 Days)			
No			1.00
Yes			2.39 (2.04, 2.79)**
Marijuana Use (Past 30 Days)			
No			1.00
Yes			3.40 (2.91, 3.98)**
Cocaine Use (Past 30 Days)			
No			1.00
Yes			3.55 (2.44, 5.17)**
Median Odds Ratio [95% CI]	3.02 [2.13, 4.92]	1.79 [1.47, 4.05]	1.58 [1.33, 2.07]

[a]The ACHA-NCHA II does not have measures of distal predisposing influences and proximal immediate predictors in the sociocultural environment stream.

[b]Odds ratio calculations were omitted due to collinearity.

*p<0.05, **p<0.01