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Nonmedical use of prescription stimulants during college: Four-year trends in exposure opportunity, use, motives, and sources

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Abstract

Objective—Examine trends in nonmedical use of prescription stimulants (NPS), including motives, routes of administration, sources, cost, and risk factors.

Participants—1,253 college students.

Methods—Data were collected annually during academic years 2004–5 through 2008–9. Generalized estimating equations analyses evaluated longitudinal trends. Logistic regression models evaluated stability of associations between risk factors and NPS over time.

Results—Almost two-thirds (61.8%$_{wt}$) were offered prescription stimulants for nonmedical use by Year 4, and 31.0%$_{wt}$ used. Studying was the predominant motive (73.8 to 91.5% annually), intranasal administration was modest (<17% annually), and the most common source was a friend with a prescription (≥73.9% annually). Significant changes over time included: decreasing curiosity motives, increasing overuse of one's own prescription, and increasing proportion paying $5+ per pill. Lower GPA and alcohol/cannabis use disorders were consistently associated with NPS, holding constant other factors.

Conclusions—Prevention opportunities exist for parents, physicians, and college administrators to reduce NPS.

Keywords

academic performance; college students; longitudinal studies; nonmedical prescription drug use; prescription drug abuse; substance use

INTRODUCTION

There has been a recent surge of interest in understanding nonmedical use of prescription stimulants (NPS) among college students.[1, 2] Studies estimate that 4.1% to 10.8% of college students have used a prescription stimulant without a legitimate prescription in the past year,[3–7] with lifetime prevalence estimates ranging from 6.9% to 35.6%.[3–13] Fraternity members are at even higher risk for NPS, with lifetime estimates as high as 55%.[14]

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Cross-sectional research has shed light on several aspects of NPS. For example, students who use prescription stimulants nonmedically typically report a variety of motives for use, including to study,[7, 11, 15, 16] to improve focus/concentration,[7] to stay awake,[11] and for recreation.[7, 15, 17] A recent study found that 76% of college nonmedical users *believe* their nonmedical use improves their grades,[18] although research suggests that nonmedical use is associated with lower academic performance.[4, 6] Another study observed that only 30% of students in their sample used methylphenidate *exclusively* to study.[17]

While it appears that most students take prescription stimulants orally,[13] a few studies reported that a sizeable minority of nonmedical users administer the drugs intranasally.[7, 9] One of the major risk factors for intranasal use is using prescription stimulants to get high rather than to study.[17] Additionally, prescription stimulants are usually obtained from friends[14] with prescriptions for little to no cost.[9, 15]

Finally, across studies, several correlates of NPS have been consistently observed. With respect to demographics, Whites[6, 7, 15] and males[6, 13] have elevated rates of NPS. NPS is associated with fraternity and sorority membership[6] and lower grade point average,[4, 6] perhaps because of the association between NPS and possible attention difficulties,[8, 18, 19] psychological distress,[20] and/or depressed mood.[21, 22] In addition, NPS is also associated with having a history of alcohol or other drug involvement.[6]

Although cross-sectional research is valuable, longitudinal data are necessary to understand trends in the prevalence, motives, routes of administration, and sources of prescription stimulants as students move through their college career. This longitudinal study aims to: 1) describe trends of exposure opportunity and NPS; 2) examine variations in the prevalence of motives, routes of administration, sources, and cost of prescription stimulants across time; and 3) examine whether or not the associations between risk factors and NPS remain stable across time in college in order to guide prevention and intervention activities.

METHODS

Study Design

Participants were 1,253 individuals enrolled in the College Life Study,[23] a longitudinal study using a single cohort of students from a large, public university in the mid-Atlantic region of the U.S. The sample was selected in two stages. First, 3,401 incoming first-time, first-year students, aged 17 to 19, completed a brief screening survey during new-student orientation in 2004. Next, a stratified random sample of participants was selected for follow-up, with oversampling of students who had used an illicit drug at least once during high school. Overall, 1,253 (86.5% response rate) participants completed the two-hour baseline (Year 1) assessment consisting of a personal interview and self-administered questionnaires during their first year in college (2004–05 academic year). Similar two-hour assessments were conducted annually thereafter, regardless of continued college enrollment. Follow-up rates for Years 2, 3, and 4 were 91.1% (n=1,142), 87.9% (n=1,101), and 87.6% (n=1,097), respectively. Interviews were administered by similar-aged individuals who were trained extensively on research procedures and interviewing techniques. Participants were paid $50 for each assessment, with an additional $20 bonus for on-time completion (within 4 weeks of the anniversary of their Year 1 assessment date) of each follow-up assessment. The study was approved by the university's IRB, with informed consent obtained in writing. A federal Certificate of Confidentiality was obtained.

Participants

Data for the present study are taken from the first four annual assessments (hereinafter referred to as Year 1 through Year 4). For many participants, these annual interviews correspond to the first four years of college. The vast majority (87%) of participants were still enrolled at the same university by Year 4; approximately 2% had graduated and 12% transferred to another institution or dropped out of school. The sample was 49% male and 71% White. The average family income was $73,426.

Inclusion/Exclusion Criteria by Aim

Aim 1: Describe Trends of Exposure Opportunity and NPS—To examine exposure opportunity and NPS in each year of college, the samples consisted of individuals with non-missing annual data in that year. One participant was excluded from both Year 1 and Year 2 due to missing data on NPS, yielding sample sizes of 1,252 in Year 1, 1,141 in Year 2, 1,101 in Year 3, and 1,097 in Year 4. Females were slightly overrepresented in Year 4, compared to the sample from which the participants were drawn, but no other demographic differences were found.

Aim 2: Examine Variations in Motives and Behaviors across Time—For Aim 2, the sample was limited to participants who used prescription stimulants nonmedically in the past year at each assessment. This yielded sample sizes of 230 in Year 1, 281 in Year 2, 303 in Year 3, and 234 if Year 4. Several participants were excluded due to missing data on the dependent variable (see Table 2 notes). Females were less likely than males to engage in NPS in Years 3 and 4 and racial minorities were less likely to use in all years.

Aim 3: Examine Associations between Risk Factors and NPS across Time—Regression models to investigate the influence of various risk factors on NPS were developed from data on individuals who had exposure opportunity in the given time frame (lifetime in Year 1, past-year in Years 2, 3, and 4) and non-missing data on all risk factors for the analytic year. In Year 1, 30 participants were excluded due to missing data, yielding a sample size of 530. Similarly, in Years 2, 3, and 4 there were 64, 43, and 40 participants excluded due to missing data, yielding sample sizes of 455, 464, and 363, respectively. Compared to the population from which the sample was drawn, Whites were overrepresented in Years 1, 2, and 3, and family income was higher among included participants in Years 1 and 2.

Measures

Exposure Opportunity of Prescription Stimulants—In Year 1, participants were asked: “Sometimes people are offered a chance to try prescription stimulants nonmedically. How old were you the first time you were offered prescription stimulants?” Age at first opportunity was recorded. In subsequent interviews, participants were asked, “In the past 12 months, on how many days were you offered prescription stimulants for nonmedical use?” Data were dichotomized into participants who did and did not have exposure opportunity each year.

NPS and Age of Initiation—A similar series of questions, adapted from the National Survey on Drug Use and Health (NSDUH),[24] assessed lifetime (in Year 1) and past-year (in Years 2 through 4) NPS. Nonmedical use was defined for participants as use without a prescription, overuse of a prescribed medication, or use of a medication only for the experience or feeling it caused. Age of first use was recorded. Latency between opportunity and first use was computed as the number of years between first opportunity and first use.

Motives—Annually, participants were asked, “What were the reasons you had for using <prescription stimulant>?” for each type of prescription stimulant they used nonmedically. Responses were recorded verbatim and subsequently coded into five categories: a) curiosity/

experimentation; b) improve focus/ study/work; c) stay awake to party; d) get high/feel good; and e) other reasons. Multiple responses were allowed.

Routes of Administration, Sources, and Cost of Prescription Stimulants—The following domains were assessed annually for each prescription stimulant used. First, all routes of administration were recorded verbatim and later coded into a series of binary variables representing five possible routes: a) swallowed whole; b) crushed and snorted; c) injected; d) crushed and swallowed; and e) other routes. Source was assessed by asking "How did you obtain <prescription stimulant>?" Due to small cell sizes, friends with an unknown prescription status, relatives, and strangers were collapsed into an overall "other" category. Finally, users were asked "How much did you typically pay for each tablet?" If obtained for free, the cost was recorded as $0.

Demographics—Gender was recorded by the interviewer in Year 1. Race was self-reported. Due to small cell sizes of minority groups, race was dichotomized into White and non-White. Age was provided by university records as allowed by informed consent. Family income was approximated by the mean adjusted gross income of the participant's home ZIP code during their last year in high school.[25] Family income is reported in ten-thousand-dollar increments.

Extracurricular Activity Involvement—Annually, participants were asked how regularly they participated in four types of extracurricular activities in a typical week during the current academic year: a) volunteer work; b) religious/church groups; c) athletics; and d) other activities. Beginning in Year 2, participants were also asked how often they participated in fraternities/sororities. Response options were "none", "irregular" (defined as occasional/some of the time), and "regular" (defined as frequent/most of the time). Participation was dichotomized into "no participation" and "irregular/regular participation".

Grade Point Average—Grade Point Average (GPA) for each semester was obtained from university administrative data, as allowed by informed consent. Annual GPA was computed based on these data. In 51 cases, only one semester of GPA data was available and was used as the approximate annual GPA for that year. GPA data were only available from the university in which participants began as first-year students; therefore GPA data were missing from participants who transferred schools or took time off from college.

Alcohol Use Disorder—Annually, participants who had used alcohol at least five times during the past year were assessed for alcohol use disorder (AUD) through a series of questions adapted from the NSDUH interview.[24] Consistent with DSM-IV criteria,[26] dependence was assigned when three or more of the following seven criteria were endorsed as a result of past-year alcohol use: a) tolerance; b) withdrawal; c) using more than intended; d) being unable to cut down; e) spending a lot of time obtaining or using; f) giving up important activities; or g) continuing to use despite problems with physical or mental health. Similarly, alcohol abuse was assigned when non-dependent individuals endorsed one or more of the following four criteria as a result of their past-year alcohol use: a) having serious problems at home, work, or school; b) regularly putting oneself in physical danger; c) repeatedly getting into trouble with the law; and d) continuing to use despite problems with family or friends. Participants meeting criteria for either abuse or dependence were collapsed into one category denoting AUD.

Cannabis Use Disorder—Cannabis use disorder (CUD) was assessed similarly to AUD with one exception. Withdrawal was not assessed,[26] so cannabis dependence was assigned when three or more of the following six criteria were endorsed as a result of cannabis use in the past year: a) tolerance; b) using more than intended; c) being unable to cut down; d) spending a lot of time obtaining or using; e) giving up important activities; and f) continuing to use despite problems with physical or mental health.

Statistical Analyses

Because some groups were over-represented during sampling, sampling weights based on gender, race, and prior drug use were computed to reflect the general population of students from which the sample was drawn.[23] Sampling weights were calculated by dividing the number of screened individuals in each gender-race-drug use cell by the corresponding number of sampled individuals. Prevalence estimates for past-year and lifetime opportunity, use, and use given opportunity were computed using these weights.

To address Aim 1 regarding exposure opportunity and NPS over time, characteristics of nonmedical prescription stimulant opportunity and use over time were evaluated through a series of generalized estimating equations (GEE) repeated measures analyses.[27, 28] First, for the entire sample, opportunity was entered as the dependent variable, and year was included as the repeated factor. Similarly, in a separate equation, use was entered as the dependent variable, with year as the repeating factor. Following these bivariate associations, each of these two regression models was re-estimated with year as the repeating factor and the main effect of gender and first-order interaction of gender*year included in the equations. Next, to address Aim 2 regarding variations in motivations, routes of administration, sources, and costs of NPS over time, GEE repeated measures equations were developed for nonmedical users, in which each motive, route of administration, source, and cost were, in turn, entered into separate equations as the dependent variables, with year as the repeating factor in each equation. Again, following bivariate analyses, each equation was re-estimated with year as the repeating factor and the main effect of gender and the first-order interaction of gender*year included in the model. For all models associated with Aims 1 and 2, a Wald chi-square test determined whether or not year, gender and the gender*year interaction were significantly associated with each dependent variable. For models with significant chi-square tests, pair-wise comparisons of estimated marginal means produced from these models were evaluated using Bonferroni correction for multiple comparisons in order to determine among which years the participants differed with respect to the dependent variable.

Finally, to address Aim 3 (examining the association between risk factors and NPS over time), multiple logistic regression models were estimated to discern the stability of the associations between risk factors and NPS. NPS was entered as the dependent variable in models for each of the four years of study, with demographic characteristics, extracurricular involvement, GPA, AUD, and CUD entered as independent variables. Individuals without past-year exposure opportunity were excluded from the regression modeling procedures. For ease of interpretation, adjusted odds ratios are presented.

RESULTS

Prevalence of Exposure Opportunity and NPS

By Year 4, 61.8%$_{wt}$ of students were offered prescription stimulants at least once (Table 1), and approximately one-third (31.0%$_{wt}$) had used a prescription stimulant nonmedically. Frequency of past-year NPS was stable over time, averaging 11.3 days (*SD*=15.3) in Year 2, 12.1 days (*SD*=20.8) in Year 3, and 13.8 days (*SD*=24.2) in Year 4. Males had significantly more exposure opportunity than females in Years 2 and 4. Among participants offered prescription stimulants, between 34.4%$_{wt}$ and 41.5%$_{wt}$ used. Although males had a higher likelihood of NPS than females at all time points, exposure opportunity appeared to account for this difference in Years 1 and 2. Overall, 45.8% of students offered prescription stimulants in college used nonmedically during the same year in which they had exposure opportunity.

The mean age at which individuals first had exposure opportunity was 18 (*M*=17.94, *SD*=1.81) and did not differ between males and females; however, on average, males initiated NPS at an older age (*M*=18.65, *SD*=1.73) than females (*M*=18.29, *SD*=1.80; *p*=0.02). Time between first opportunity and first use was approximately one year (*M*=0.97, *SD*=1.36) and was similar between males and females.

Motives, Routes of Administration, Source, and Cost

The GEE analysis shows that curiosity was more likely to be endorsed as a motive for NPS early in college as compared to later years (Table 2; compared to Year 4: β=2.85, *95%CI*=1.65 to 4.04, $p<0.01$ for Year 1; β=1.47, *95%CI*=0.21 to 2.73, $p=0.02$ for Year 2; β=0.86, *95%CI*= -0.47 to 2.19, $p=0.20$ for Year 3). Studying was the most commonly endorsed motive for NPS every year. Swallowing a pill whole was the most common route of administration in every year. No significant associations between year and route of administration or significant gender*year interactions were observed. A friend with a prescription was the most common source every year. However, overusing medication from one's own legitimate prescription increased over time (compared to Year 4: β=-1.35, *95%CI*= −2.32 to −0.38, $p=0.01$ for Year 1; β=−1.37, *95%CI*=−2.08 to −0.66, $p<0.01$ for Year 2; β=−0.49, *95%CI*=−0.95 to −0.03, $p=0.04$ for Year 3). Finally, although most users paid nothing for the prescription stimulants they used nonmedically, the percentage who paid $5 or more per pill increased significantly over time (compared to Year 4: β=−1.08, *95%CI*=−1.64 to 0.52, $p<0.01$ for Year 1; β=−0.47, *95%CI*=−0.92 to −0.02, $p=0.04$ for Year 2; β=−0.30, *95%CI*=−0.70 to 0.10, $p=0.15$ for Year 3).

Stability of Associations between Risk Factors and NPS

Consistently, logistic regression models show that NPS was associated with lower GPA as well as AUD or CUD (Table 3). The magnitude of the association between CUD and NPS increased over time (*AOR*=2.24, *95%CI*=1.48 to 3.41 and *AOR*=4.81, *95%CI*=2.95 to 7.97 in Years 1 and 3, respectively). Only in Year 4 was participating in volunteer work associated with a decreased likelihood of NPS (*AOR*=0.57, *95%CI*=0.34 to 0.94). Interestingly, fraternity/sorority membership was not associated with NPS in any year.

Post-hoc Analysis

Because of concerns regarding potential associations between the reinforcing effects of chronic recreational and intranasal use and the onset of abuse/dependence symptoms, it was of interest to determine the extent to which the recreational use observed in our sample involved the same subgroup of individuals over time. We examined year-to-year phi correlation coefficients for indicators of recreational use consistent with this proposed subgroup: recreational motives (partying, getting high) and intranasal administration. Beyond Year 1, year-to-year correlations in motives were modest. The Year 2 to Year 3 coefficient for partying was 0.151 ($p=0.039$), 0.280 ($p=0.001$) for Years 2 to 4, and 0.454 ($p<0.001$) for Years 3 to 4. For getting high, phi coefficients were 0.254 ($p<0.001$), 0.168 ($p=0.047$), and 0.225 (*p*=0,002), respectively. Overall, in at least three of the four years of study, only four individuals reported partying and only two reported getting high as a motive for NPS. Phi coefficients for intranasal administration across the four years revealed that snorting in consecutive years was related, such that the coefficient for Year 1 to Year 2 was 0.350 ($p<0.001$), Years 2 to 3 was 0.337 ($p<0.001$), and Years 3 to 4 was 0.595 ($p<0.001$). No other comparisons were significant. Eight individuals used intranasally in at least three years. Overall, only one individual consistently used intranasally *and* consistently endorsed one of the recreational motives.

COMMENT

Several important findings emerged from this study. First, NPS is widespread, with 61.8%$_{wt}$ of college students being offered prescription stimulants for nonmedical use at least once by Year 4, and 31.0%$_{wt}$ having used at least once in their lifetime. It is possible that the lifetime prevalence estimate was higher in this study than prior studies because we included overusing one's own medication in our definition of nonmedical use. However, this is consistent with prior work.[9] Past-year use ranged from 16.1%$_{wt}$ to 20.1%$_{wt}$, with males having a greater likelihood of NPS than females. Once exposure opportunity was taken into account, prevalence was similar for males and females in the first two years.

Second, motives, sources, and cost of prescription stimulants changed over time, advancing the findings of previous cross-sectional studies. Curiosity motives were more prevalent in the beginning of college, with studying motives becoming more common in later years. This finding is consistent with the notion that NPS is fueled by a desire to succeed academically,[7, 11] and that prescription stimulants might be used during periods of academic stress.[14, 16] This pattern of change in motives suggests that later in college, NPS may become somewhat less about novelty-seeking and drug use *per se*, and more utilitarian in the pursuit of an academic shortcut to achieve better grades. Unfortunately, over the long run this strategy might be misguided. Academic success is best achieved by attending class regularly, completing assignments in a timely manner, and studying regularly rather than using prescription stimulants to stay awake to study for exams or complete assignments at the last minute.[4]

Consistent with prior literature,[9, 14, 15] friends with a prescription were the most common source for obtaining prescription stimulants, and most obtained their drugs for free; however, the proportion willing to spend $5 or more per pill more than doubled over time. While several factors might account for this increase (e.g., increased disposable income, increased demand), it is possible that, for a subset of users, an increase in perceived need has occurred, such that they are willing to pay more to obtain prescription stimulants, rather than using it simply because it is easily obtainable at no cost.

Predictors of NPS were fairly consistent over time. Although previous research revealed demographic differences in NPS with respect to gender and race,[3, 6] this study demonstrates that once other factors — especially AUD, CUD, and GPA — are taken into account, these demographic differences are not significantly related to NPS. It is interesting that fraternity/sorority membership was unrelated to NPS, despite the strong associations found in prior research.[6] Most likely, heavy alcohol and drug involvement were confounding the relationship between NPS and fraternity/sorority involvement in prior studies, so that once controlled for, the fraternity/sorority environment *per se* appears not to be a significant influence on NPS. Given that academic problems and substance use were strongly associated with NPS,[3, 6] professionals working with students who are experiencing academic difficulties should assess possible underlying substance abuse problems.

The observed increase in the prevalence of over-use of one's own prescription is interesting. This finding could be interpreted in several ways. First, it is possible that more individuals are being treated for Attention-Deficit/Hyperactivity Disorder (ADHD) later in college because they have had more time to receive a diagnosis and access treatment. Second, some students with ADHD might find that their dosage is no longer sufficient to manage symptoms as they get older and experience the increased task demands of college, and therefore begin overusing their medication. Third, having had more time to develop a pattern of habitual NPS, and having experienced real or perceived benefits from NPS early in college, some upperclassmen might seek out a diagnosis of ADHD as a means of ensuring a steady supply of prescription stimulants. Further study is warranted to explore these possible scenarios.

The risk for developing dependence on prescription stimulants is a consequence of particular concern in this population, and despite the above indications that some students might be developing more serious patterns of NPS by the end of college, we found that a minority of students were using the drug intranasally. Intranasal administration could be an important risk factor for dependence, because it produces stronger reinforcing effects than oral administration. In our sample, less than 17% of nonmedical users in any given year used the drug intranasally, a finding that comports with at least one prior study[13] yet is far lower than the 38–40% observed elsewhere.[7, 9] Whether this disparity reflects differences in study methodologies (time frame of reference, for example), secular changes in the availability of abuse-resistant formulations, or other factors remains to be seen. It is interesting to note that differences in intranasal administration might parallel differences in recreational motives, which are typically associated with intranasal use.[17] In comparing two studies in which both route of administration and motivations were reported, the study in which 31% of the sample reported NPS for the purpose of getting high had relatively high rates of intranasal use (38%)[7] compared to another study in which 12% reported using prescription stimulants to party and 12% had used intranasally;[13] thus, our high prevalence of study motives may be related to our low prevalence of intranasal use. Moreover, in our post-hoc analyses we found no evidence to support the presence of a subset of nonmedical users with a consistent pattern of recreational motives or intranasal administration. Instead, it appears that in the vast majority of cases, recreational motives (and intranasal administration) were only a transitory phenomenon, and it is possible that some of these individuals stopped using prescription stimulants altogether.

Limitations

This study comes from a single cohort from one large public university, thus it is expected that its findings are most generalizable to other large university settings. Because the data were gathered via self-report, findings are subject to recall bias. Since the NPS questions were interviewer-administered, it is possible that students were reluctant to fully disclose their NPS. However, given the high prevalence of NPS in the sample, it is unlikely that students were disinclined to volunteer this information. Additionally, because GPA data was missing for students who had transferred or dropped out of school, the regression models for later years (particularly Year 3 and Year 4) are most applicable to students who are continuously enrolled. However, given that the association between low GPA and substance use is a strong and consistent one throughout the literature, it is likely that those transferring to another institution would show a similar relationship between GPA and NPS. It is also possible, but unlikely, that past-year recall of NPS might have varied based on when the interview was administered during the year. During the course of the year, more than 1000 interviews were conducted, meaning that some individuals were interviewed close to exam time, while others were interviewed mid-semester. It is possible that when asked about the frequency of use in the past year, individuals who were interviewed close to exam time might have been more likely to recall NPS than those interviewed mid-semester.

Finally, additional potential risk factors should be explored. Future research should examine psychological, neuropsychological, and emotional aspects that may contribute to NPS, as prior work has shown associations between NPS and ADHD symptoms,[8] depressive mood,[21, 22] alcohol use disorder[29] and illicit drug use disorders.[29] Additional research clarifying directional relationships between these factors and NPS is needed.

Conclusions

The study findings have implications for clinicians, college administrators, and researchers. Clinicians should be aware of the likelihood of medication overuse among their college-age patients with ADHD, and, given that the most common source of prescription stimulants used nonmedically was a friend with a prescription, physicians should caution patients against sharing or selling their medications. Research is underway examining factors that influence diversion,[30] and what role physicians can play in this decision-making process. Physicians should be cognizant of possible medication-seeking among young adults who self-report ADHD symptoms but do not meet standard criteria for the disorder. In both existing and new patients, physicians should consider assessing for concomitant illicit drug use (via urine toxicology screening) as a routine part of their medical care. Finally, physicians should exercise caution with regard to prescribing practices and implement even more intensive monitoring with patients who have a history of alcohol or drug abuse. This study found that AUD and CUD were significantly associated with NPS, implying that among patients with ADHD and comorbid drug/alcohol problems, alternative therapies or non-stimulant medication alternatives should be explored.

College administrators need to be aware that NPS is prevalent on college campuses. In this sample, almost one-third of participants had engaged in NPS by Year 4. Equally important, this study demonstrates that, although motives may change, NPS continues to be prevalent across all four years of college, indicating that NPS needs to be addressed not only with first-year students but throughout college, and that the health risks of NPS (including possible dependence and cardiovascular complications, especially when combined with other drugs[31, 32]) should be made clear. Presentations during new-student orientation could include discussions of the risks of NPS, the effects of peer pressure to target curiosity-driven first-year students, and to counter the prevalent belief that NPS can be beneficial for academic success. Given the shift in motives for NPS following the first year, in later years, students who are struggling academically should be assessed for NPS and brief interventions could be evaluated for their utility in reducing drug and alcohol involvement, given that NPS is more common among students with lower GPAs.[4, 6] This type of screening could be conducted in conjunction with standard interventions already in place for students to hone their time management and study skills which, as an alternative to NPS, will enable them to respond more constructively to the pressures of college life.

NPS is a complex behavior that requires the attention of students, parents, clinicians, and college administrators. Only through a better understanding of NPS can effective prevention and intervention strategies be implemented, with the ultimate goal of ensuring academic success among college students. During the college years, when task demands are high, it is necessary for colleges to establish support systems to address the needs of students who might be experiencing academic problems and therefore be at high-risk for NPS. College might be an opportune time to educate students about the risks associated with prescription drug diversion as well as address NPS and other forms of drug involvement before problems escalate.

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TABLE 1

Opportunity to use prescription stimulants and nonmedical use by year and gender among all participants (*n*=1,253)

	Males ***n*** **(%$_{wt}$)**	**Females** ***n*** **(%$_{wt}$)**	**Total** ***n*** **(%$_{wt}$)**
% offered prescription stimulants			
Lifetime by Year 1	285 (36.7)	175 (35.2)	560 (36.0)
Past-year in Year 2	262 (41.9)	260 (35.3)*	522 (38.5)
Past-year in Year 3	251 (42.7)	257 (39.7)	508 (41.1)
Past-year in Year 4	209 (34.5)	194 (29.8)*	403 (32.0)
Lifetime by Year 4	430 (61.2)	442 (62.3)	872 (61.8)
% used prescription stimulants			
Lifetime by Year 1	117 (13.9)	113 (12.7)*	230 (13.3)
Past-year in Year 2	149 (19.9)	132 (16.1)*	281 (17.9)
Past-year in Year 3	157 (23.2)	146 (17.3)*	303 (20.1)
Past-year in Year 4	135 (21.3)	99 (11.5)*	234 (16.1)
Lifetime by Year 4	266 (34.2)	239 (27.8)*	505 (31.0)
% used given opportunity			
Lifetime by Year 1	109 (35.3)	106 (33.5)	215 (34.4)
Past-year in Year 2	125 (40.6)	109 (36.3)	234 (38.6)
Past-year in Year 3	128 (46.0)	123 (37.1)*	251 (41.5)
Past-year in Year 4	107 (50.9)	71 (28.3)*	178 (39.7)
Lifetime by Year 4[a]	247 (51.6)	218 (40.2)	465 (45.8)

* Females are significantly different from males ($p<.05$)

[a] Based on the number of participants who were offered prescription stimulants for nonmedical use and subsequently used prescription stimulants nonmedically in the same year, during any year of study

TABLE 2

Longitudinal patterns of nonmedical prescription stimulant use among nonmedical users[a,b]

	Lifetime by Year 1 (*n*=230) *n* (%)	Year 2 (*n*=281) *n* (%)	Year 3 (*n*=303) *n* (%)	Year 4 (*n*=234) *n* (%)
Motive				
Study [c]	166 (73.8)	252 (91.3)	268 (89.0)	214 (91.5)
Curiosity [c,d]	42 (18.7)	15 (5.4)	9 (3.0)	3 (1.3)
Stay awake to party	29 (12.9)	27 (9.8)	37 (12.3)	34 (14.5)
Other [e]	18 (8.0)	7 (2.5)	20 (6.6)	14 (6.0)
Get high	13 (5.8)	17 (6.2)	15 (5.0)	15 (6.4)
Route of administration				
Swallowed whole	176 (89.3)	252 (92.7)	278 (92.4)	215 (91.9)
Snorted	27 (13.7)	39 (14.3)	50 (16.6)	30 (12.8)
Swallowed crushed	5 (2.5)	6 (2.2)	7 (2.3)	8 (3.4)
Other	1 (0.5)	4 (1.5)	2 (0.7)	5 (2.1)
Source of obtaining prescription drug for nonmedical use				
Friend with prescription	174 (76.0)	217 (78.3)	233 (77.4)	173 (73.9)
Friend without prescription	34 (14.9)	59 (21.3)	53 (17.6)	39 (16.7)
Other	23 (10.0)	35 (12.6)	25 (8.3)	19 (8.1)
Self [d,f]	7 (3.1)	6 (2.2)	16 (5.3)	19 (8.1)
Internet	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cost				
$0	167 (73.6)	188 (68.6)	207 (69.2)	157 (67.4)
$1-$4	41 (18.1)	77 (28.1)	63 (21.1)	52 (22.3)
$5+ [f,h]	19 (8.4)	41 (15.0)	50 (16.7)	51 (21.9)

[a] Multiple responses were permitted each year for motives, routes of administration, sources, and costs, so columns may not sum to 100%.

[b] Missing data: Motives were missing for five individuals in Year 1, five in Year 2, and two in Year 3. Routes of administration were missing for 34 participants in Year 1, five in Year 2, and two in Year 3. Source was missing for one participant in Year 1, four in Year 2, and two in Year 3. Cost was missing for three participants in Year 1, four in Year 2, four in Year 3 and one in Year 4.

[c] Pairwise comparisons show a significant difference between Year 1 and all subsequent years ($p<.05$).

[d] Pairwise comparisons show a significant difference between Year 2 and Year 4 ($p<.05$).

[e] Pairwise comparisons show a significant difference between Year 1 and Year 2 ($p<.05$).

[f] Pairwise comparisons show a significant difference between Year 1 and Year 4 ($p<.05$).

[h] Pairwise comparisons show a significant difference between Year 1 and Year 3 ($p<.05$).

TABLE 3

Associations between nonmedical use of prescription stimulants and demographic factors, extracurricular activities, grade point average, alcohol use disorder, and cannabis use disorder, among those who were given the opportunity to use prescription stimulant nonmedically, by year.

	Year 1 (*n*=530) *AOR (CI)*	**Year 2 (*n*=455) *AOR (CI)***	**Year 3 (*n*=464) *AOR (CI)***	**Year 4 (*n*=363) *AOR (CI)***
Gender (ref=female)	0.69 (0.46–1.02)	0.92 (0.59–1.44)	0.65 (0.41–1.03)	1.62 (0.96–2.74)
Race (ref=nonwhite)	1.16 (0.72–1.86)	0.88 (0.54–1.43)	1.37 (0.84–2.24)	1.19 (0.70–2.01)
SES (Mean AGI [a])	0.98 (0.93–1.03)	0.97 (0.92–1.03)	0.94 (0.89–1.00)	1.03 (0.96–1.11)
Volunteer work involvement	0.78 (0.52–1.17)	0.70 (0.46–1.08)	0.78 (0.50–1.22)	0.57 (0.34–0.94)*
Religious or church group involvement	0.66 (0.42–1.03)	0.94 (0.61–1.45)	0.83 (0.53–1.30)	0.65 (0.39–1.09)
Athletics involvement	1.44 (0.97–2.14)	1.31 (0.84–2.04)	1.12 (0.70–1.78)	0.77 (0.44–1.33)
Fraternity/sorority involvement	–	1.41 (0.90–2.19)	1.34 (0.85–2.09)	1.47 (0.89–2.42)
Grade point average	0.68 (0.50–0.92)*	0.65 (0.47–0.89)*	0.51 (0.35–0.75)*	0.59 (0.39–0.90)*
Alcohol use disorder (ref=no disorder)	1.75 (1.20–2.56)*	1.89 (1.24–2.87)*	1.76 (1.15–2.69)*	1.24 (0.77–2.02)
Cannabis use disorder (ref=no disorder)	2.24 (1.48–3.41)*	3.05 (1.94–4.79)*	4.81 (2.95–7.97)*	3.84 (2.32–6.35)*

* $p<.05$

[a] The mean adjusted gross income (AGI) reported by the Internal Revenue Service for each participant's home ZIP code during their last year in high school, measured in ten thousands.