Evaluation of nonmedical use of prescription stimulants by college students at three northeastern pharmacy schools

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Objective: To evaluate the prevalence of self-reported nonmedical prescription stimulant use among college students of three northeastern pharmacy schools in the United States by examining the relationship of nonmedical use with underlying factors, academic performance, consequences associated with drug abuse, and quality of life (QOL).

Methods: This study was approved by the respective institutional review boards of the pharmacy schools involved. Data were collected from consenting students in their first, second, and third professional years using an anonymous survey between April and September 2017. The survey assessed underlying factors, self-reported grade point average (GPA), and patterns of nonmedical use. Patient-reported outcome (PRO) measures included were the Drug Abuse Screening Test (DAST-10) to assess consequences associated with drug abuse and the Short Form (SF-12) to measure QOL.

Results: In total, 651 responses of 1201 students surveyed were collected. In the included sample, 11.6% of students reported nonmedical use of prescription stimulants during college, with varying reported frequencies from 36% using once or twice to 8% using regularly. Factors associated with increased odds of nonmedical use with statistical significance included male gender (odds ratio [OR] 2.75, 95% confidence interval [CI]: 1.68-4.52, \( P = 0.001 \)) and fraternity or sorority involvement (OR 2.84, 95% CI: 1.72-4.70, \( P = 0.001 \)). Nonmedical users had statistically lower GPAs (3.38, 95% CI: 3.44-3.50) than nonusers (3.47, 95% CI: 3.30-3.45, \( P = 0.02 \)), and increased risks associated with drug abuse, as measured by the DAST-10. No significant differences in QOL were found between nonmedical users and nonusers, as measured by the SF-12.

Conclusion: The findings examined the impact of nonmedical prescription stimulant use by pharmacy students and found that nonmedical use was similar to rates observed by college students in other studies. Nonmedical use is associated with lower GPA and increased risks associated with drug abuse. More research must be conducted to understand and increase awareness of the effects of prescription stimulants.

KEYWORDS
amphetamine, central nervous system stimulants, health-related quality of life, methylphenidate, nonmedical use of prescription drugs, pharmacy students
1 | INTRODUCTION

Prescription stimulants are increasingly being used for nonmedical purposes by young adults for their potential cognitive enhancement effects.1 Prescription stimulants such as methylphenidate, dextroamphetamine, and amphetamine are currently first-line pharmacotherapy for treating attention deficit hyperactivity disorder (ADHD).1 However, several studies have examined their nonmedical use, defined as taking a prescription drug without a prescription or in a way other than prescribed. Literature has shown evidence of nonmedical use by students and young professionals of ADHD medications including amphetamine (Adderall), dextroamphetamine (Dexedrine), lisdexamfetamine (Vyvanse), methylphenidate (Ritalin, Concerta, and Daytrana), and dexamphetamine (Focalin), as well as the wakefulness-promoting drug, modafinil (Provigil).1-3 Data suggest that nonmedical use at individual colleges ranges between 0% and 25%, with a 6.9% average prevalence during students’ time in college.1 Evidence has shown that prescription stimulants have beneficial cognitive effects, including increased attention, increased cognitive speed, or shortening of reaction times.2 Anecdotal evidence and headlines reference prescription stimulants as “smart drugs,” “performance enhancers,” or “smart doping.”3 In a study of more than 3400 undergraduate students attending one public and one private university in the southeastern United States, the most frequently reported motive for nonmedical use of prescription stimulants was enhancement of the ability to study.4 While evidence supports the effects of prescription stimulants in improving focus and concentration, the impact of nonmedical use on academic performance has been difficult to determine.3,5

Young adults 18 to 24 years of age have been shown to be the largest group to use, abuse, or have dependence on prescription stimulants.5,6 Nonmedical use is closely tied to college campuses, as it is two times as prevalent among college students than young adults of the same age not attending college.5,6 In a study of 119 four-year colleges in the United States of a representative sample of 10 904 randomly selected students in 2001, the average past year prevalence of nonmedical use was 4.1%.3 Rates were higher in colleges in the northeast and with more competitive admission standards. Students who were male, white, fraternity and sorority members, and earned lower grade point averages were also found to have higher incidence of nonmedical use.6 The prevalence of nonmedical use is facilitated by the access students have to prescription stimulants. In a study of undergraduate students attending a large public university in the Midwestern United States in the spring of 2003, friends and peers were the leading sources of prescription stimulants for nonmedical use, often fellow students with an existing diagnosis of ADHD and legitimate prescriptions.7 Students reported that these medications could be obtained for as little as $3 to $5 per pill.8

In three national surveys conducted from 2006 to 2011, stimulant use and emergency department (ED) visits involving dextroamphetamine-amphetamine or methylphenidate remained stable or declined in adolescents but nonmedical use increased by 67.1%, and ED visits related to either drug increased by 155.9% in adults.9 The prevailing view among students, parents, and even some physicians is that nonmedical use of prescription stimulants is benign and generally harmless.3,5-7 Side effects of prescription stimulants include cardiac abnormalities, tachycardia, anorexia, insomnia, anxiety, growth suppression, and irritability.10-12 More concerning, prescription stimulants carry boxed warnings for serious cardiovascular events, including sudden death associated with stimulant treatment at usual doses, and potential tolerance and psychological dependence.10-12 The potentially serious adverse effects of prescription stimulants raise concerns of the risks and benefits of nonmedical use.

Nonmedical use of prescription stimulants is notable in health care professional students because of greater academic pressures, in addition to knowledge of the risks and benefits of prescription stimulants. Elevated stress levels, underlying psychiatric disorders, and illicit drug and prescription stimulant misuse can be prevalent in these students, which may contribute to the growing problem.13 In a study published in 2015, nonmedical prescription stimulant use was reported to be 6.1% in pharmacy students, 10.4% in medical students, and 14.0% in physician assistant students.14

The objective of this study was to benchmark the prevalence of self-reported nonmedical prescription stimulant use among college students from three northeastern pharmacy schools and examine the relationship of nonmedical use with underlying factors, academic performance, problems relating to drug abuse, and quality of life (QOL). We theorize that despite anecdotal evidence that prescription stimulants can enhance cognition, there will be no correlation between nonmedical use and academic performance. In addition, prescription stimulant use will be correlated with increased problems associated with drug abuse and lower QOL.

2 | METHODS

The study was reviewed and approved by the institutional review boards of three northeastern pharmacy schools, identified as schools X, Y, and Z. Pharmacy students in the didactic portion of their pharmacy training in the first, second, or third professional year without a prior diagnosis of ADHD were included in the study. Exclusion criteria included students who self-reported a diagnosis of ADHD, nonpharmacy students, and fourth professional year pharmacy students. Fourth year pharmacy students were excluded because they were on Advanced Pharmacy Practice Experience (APPE) rotations at various practice sites around the country, and data collection posed a challenge. Data were collected from consenting students using a 5 to 10-minute anonymous paper survey administered after class lectures to students willing to participate in a brief research study between April and September 2017.

The survey consisted of four sections to answer the study objectives: (1) to assess patterns of nonmedical use using questions regarding previous diagnosis of attention deficit-hyperactivity disorder/attention deficit disorder (ADHD/ADD), frequency of use, most commonly used stimulant, and reasons for nonmedical use; prescription stimulants assessed included: amphetamine (Adderall), dextroamphetamine (Dexedrine), lisdexamfetamine (Vyvanse), methylphenidate (Ritalin, Concerta, Daytrana), dexamphetamine (Focalin), and modafinil (Provigil), (2) to determine underlying factors correlated with nonmedical use, students were asked demographic questions including gender, race or ethnicity, family income, fraternity or sorority involvement, and grade point average (GPA), (3) to determine the degree of consequences related to
drug abuse and the potential for drug dependence, the Drug Abuse Screening Test (DAST-10), a validated, self-administered instrument that provides a quantitative index of the degree of risk of abuse related with prescription, over-the-counter, or illicit drug abuse, was used; it assessed the respondent’s habits of drug use and potential consequences related to drug use, including problems with family, blackouts or flashbacks, withdrawal symptoms, medical problems, and engaging in illegal activities.\textsuperscript{14,15} (4) to assess health-associated quality of life (QOL), the Short Form (SF-12), a validated, self-administered 12-item questionnaire was used. Respondents rated their mental, physical, and emotional health and ability to complete daily activities in the past 4 weeks.\textsuperscript{16} All study participants were given the entire survey. A pilot study was conducted with three second year pharmacy students to ensure that the survey could be completed in under 10 minutes.

The data analysis was conducted using STATA/MP (version 14) software. All of the variables (gender, race or ethnicity, family income, GPA, and fraternity or sorority involvement) were converted to binary variables to facilitate analysis. Logistic regression was used to determine the association of nonmedical use with each demographic factor comparing nonmedical users with nonusers.\textsuperscript{17} Each coefficient in the regression was tested using a \( t \) test at the 0.05 significance level. Descriptive statistics were used to evaluate patterns of nonmedical use. The DAST-10 results were analyzed by totaling the students’ scores, with a score higher than one measuring increased consequences of abuse between nonmedical users and nonusers and severe risk of abuse or consequences, respectively.\textsuperscript{14,15} An independent \( t \) test was used to compare mean DAST-10 scores between nonmedical users and nonusers.\textsuperscript{18} The DAST-10 results were also analyzed by risk group, with scores of 0, 1-2, 3-5, 6-8, and 9-10 reflecting no, low, intermediate, substantial, and severe risk of abuse or consequences, respectively.\textsuperscript{14,15} An ANOVA test was conducted to determine if there was a difference in problems relating to abuse between nonmedical users and nonusers and a \( F \) test was used with a 0.05 significance level to determine significance. The SF-12 results were analyzed by converting the students’ scores to a 0-100 scale, with higher scores indicating higher reported QOL. Overall means for the following scales were calculated: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), and Mental Health (MH).\textsuperscript{16,19} Nonmedical users and nonusers’ scores were compared using a \( t \) test. Students were also stratified by gender, fraternity or sorority involvement, and GPA range (GPA \( \leq 3.0 \), 3.1-3.4, 3.5-3.8, and 3.9-4.0) to compare QOL of nonmedical users and nonusers and examine the effects of differing underlying factors.

### 3 | RESULTS

(1) **Patterns of nonmedical use:** The overall response rate was 54.2%. Out of the 651 survey responses collected of 1201 pharmacy students surveyed, 24 were excluded due to an existing diagnosis of ADHD/ADD and 627 were included in the analysis of nonmedical prescription stimulant use. Seventy-two of 627 (11.5%) of respondents reported nonmedical use of prescription stimulants during their time in college. Nonmedical use differed between the three pharmacy schools, with 6.4%, 18.4%, and 13.4% of students reporting nonmedical use at colleges X, Y, and Z, respectively. Nonmedical use also differed between class year in pharmacy school, with second and third year students generally reporting greater use (Figure 1). Most students who reported nonmedical use of prescription stimulants reported infrequent use, including once or twice (35.6%) or occasionally before major exams or assignments (26.4%). Of note, 22.9% of nonmedical users reported frequent or regular use, including 6.9% using frequently before exams or assignments, 8.0% using regularly but not daily, and 8.0% using daily. The most common nonmedically used prescription stimulants were amphetamine salts (85%), lisdexamphetamine (42%), and methylphenidate (26%). Motivations for nonmedical use included: to work faster (57.5%), boost academic performance (48.0%), experimentation (32.3%), improve concentration and focus (30.6%), improve cognition (16.4%), promote wakefulness (16.4%), peer pressure (2.7%), and to lose weight (2.7%) (Figure 2).

(2) **Factors related to nonmedical use:** In the regression analysis, factors associated with increased odds of nonmedical use with statistical significance included male gender (odds ratio [OR] 2.75, 95% confidence interval [CI]: 1.68-4.52, \( P = 0.001 \)) and fraternity or sorority involvement (OR 2.84, 95% CI: 1.72-4.70, \( P = 0.001 \)). Nonmedical use was not significantly related with race or ethnicity and yearly household income. Reported nonmedical use was correlated with lower GPA, based on students’ self-reported current GPA scores. There was a significant difference between mean GPA for nonmedical users (3.38, 95% CI: 3.44-3.50) and nonusers (3.47, 95% CI: 3.30-3.45, \( P = 0.02 \)).

(3) **Consequences associated with drug abuse:** Based on DAST-10 scores, there was a significant difference between the average DAST-10 score of nonmedical users (2.53, 95% CI: 2.10-2.97) and nonusers (1.09, 95% CI: 1.01-1.18, \( P < 0.001 \)), indicating higher risk of drug abuse and consequences associated with drug abuse (Figure 3). According to the risk group, 8.2% of nonmedical users and 17.5% of nonusers had scores reflecting no risk, 82.0% of nonmedical users and 73.6% of nonusers had scores reflecting low risk, 8.2% of nonmedical users and 7.9% of nonusers had scores reflecting intermediate use, 1.6% of nonmedical users and 0.8% of nonusers had scores reflecting substantial risk, and 0% of nonmedical users and 0.2% of nonusers had scores reflecting severe risk.

(4) **Quality of life:** Based on SF-12 scores in eight scales measuring physical, social, emotional, and mental health and functioning, no significant differences in QOL were found between nonmedical users and

![Percentage of Reported Nonmedical Users by School and Class](image)
nonusers. Significant differences were also not shown in students stratified by gender, fraternity or sorority involvement, and GPA.

4 | DISCUSSION

The findings of this study should be interpreted carefully as the sample represents self-reported data from students willing to participate in the survey and may not be reflective of a larger sample. In this study, overall self-reported prevalence of nonmedical use during students' time in the first, second, or third professional year of their pharmacy training was 11.5%, ranging from 6.4% to 18.4% among the three schools. These results are consistent with previous literature findings of 0% to 25% on individual college campuses. The variation among schools may be due to differences in geographical location, socioeconomic status, epidemiology, and other characteristics between the schools. Additionally, bias related to self-reporting may be a limitation to the study, particularly due to the potentially sensitive nature of the subject matter and students' comfort level completing the survey in the classroom setting.

Various underlying factors and potential confounders including professional year, gender, race/ethnicity, fraternity and sorority involvement, and family income were examined to detect variability. Limitations in the population include that preprofessional and fourth professional year pharmacy students were excluded, and additional potential confounding factors such as employment status of the student or nonmedical use of additional drugs were not evaluated. It is important to note that these findings only correlate underlying factors with nonmedical use and cannot be interpreted to find a causative relationship. Therefore, it is not possible to conclude if the higher prevalence of nonmedical use in students in more advanced years of pharmacy training is due to students having been in college for a
longer time, the increased difficulty of pharmacy curriculum in later professional years, or other reasons. Additionally, the results cannot be interpreted to find a causative relationship between GPA and nonmedical use to determine whether students with lower GPAs felt compelled to use prescription stimulants or if nonmedical use resulted in a lower GPA.

Both the DAST-10 and SF-12 are validated patient-reported outcome (PRO) measures. While mean DAST-10 scores showed a significant difference between nonmedical users and nonusers, the difference was primarily driven by a higher number of nonusers in the no risk category and nonmedical users in the low risk category. The higher risk categories were relatively similar between nonmedical users and nonusers. A limitation may be that the DAST-10 assesses abuse and nonmedical use of other prescription, over-the-counter, or illicit drugs, but not alcohol, and the abuse or nonmedical use of additional drugs was not evaluated. No difference in the quality of life as measured by the SF-12 was found between nonmedical users and nonusers of stimulants. This finding is potentially due to most students reporting irregular and infrequent nonmedical use and the SF-12 measuring respondents’ QOL over only the previous 4 weeks.

Future research is needed to better define nonmedical use by young adults and help students understand the risks and benefits of doing so. A longitudinal cohort study examining a group of students over their time in college and their patterns of nonmedical use would be helpful in understanding causal relationships between nonmedical use, underlying factors, academic performance, consequences associated with drug abuse, and QOL. Expanding the study population to more pharmacy schools in the United States, other health care professional students, students in other areas of study, and students at colleges with varying levels of competitiveness would help elucidate students’ motivations and the potential effects of nonmedical use. Additionally, more research is needed to better understand the positive and negative outcomes of prescription stimulant use.

## 5 | CONCLUSION

Our findings suggest that nonmedical use of prescription stimulants in pharmacy school is similar to previously reported prevalence by college students. Most students who reported infrequent nonmedical use associated it with tests or assignments, however, some students reported regular or daily nonmedical use. Students most commonly were motivated by the desire to work faster, boost academic performance, experiment, or to improve concentration and focus. However, nonmedical use was associated with lower GPA, increased risk of drug abuse associated with drug abuse assessed by the DAST-10, and no difference in QOL measured by the SF-12. Future longitudinal research examining expanded student populations and other variables will be key to truly understanding the effects of nonmedical use of prescription stimulants in this population.

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## CONFLICT OF INTERESTS

The authors have no conflict of interest to report.

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