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Disentangling the Social Context of Nonmedical Use of Prescription Stimulants in College Students

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Abstract

Background and Objectives: The aim of this study was to investigate the social context of nonmedical use of prescription stimulants (NMUPS) among college students who endorsed NMUPS with co-occurring substance use disorders (SUD) compared to those without co-occurring SUDs.

Methods: Presented here are new analyses based on data previously collected from college students aged 18–28 years derived from the Boston metropolitan area who endorsed NMUPS (N=100) at least once in their lifetime. Differences between those with lifetime history of SUD (N=46) and without a history of SUD (N=54) on the Massachusetts General Hospital ADHD Medication Misuse and Diversion Assessment were analyzed using the Student T-test, the Pearson's Chi Squared Test, and the Wilcoxon Rank Sum Test.

Results: College students who endorsed NMUPS with co-occurring SUD were more likely than those without SUD to have bought or traded stimulants, bought or traded in their car, used at parties with drugs/alcohol, or used intranasally (all p values < 0.05). Intranasal administration was common (38% of all students endorsing NMUPS) and was associated with misuse at a party and simultaneous use with cocaine ($p=0.04$), marijuana ($p<0.001$), and alcohol ($p<0.001$), compared with only oral use.

Discussion and Conclusions: Notable characteristics were identified among individuals who engaged in NMUPS in the type, amount, cost, and ascertainment of stimulants.

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Scientific Significance: The concurrence of SUD and/or intranasal administration appear to represent a more severe phenotype of NMUPS that should be considered in the implementation of future prevention and intervention protocols on college campuses.

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is estimated to affect up to 8% of college students in the United States.¹ Although stimulant medications are among the first-line agents for the treatment of ADHD in adolescents and young adults² and are considered a safe and effective treatment for ADHD, consistent evidence of misuse and diversion has been reported in adolescents and young adults, (for review see³) particularly on college campuses.^{4,5} For the purposes of this study, we define nonmedical use of prescription stimulants (NMUPS) as the use of medications prescribed for ADHD without a prescription. Approximately 17% of college students have been reported to engage in NMUPS,⁶ compared to 5.6% of young adults who do not attend college.⁷ Interestingly, in contrast to having higher rates of prescription stimulant misuse, college students and graduates had lower rates of prescription opioid misuse than young adults not attending college.⁷

The increased rates of NMUPS are concerning due to the impairments, correlates, and attitudes associated with misuse. NMUPS has consistently been found to be associated with psychiatric disorders, specifically depression and ADHD.^{8,9} For example, we reported a two-fold risk for broad ADHD associated with NMUPS in a college sample.¹⁰ Students who reported NMUPS also exhibited greater deficits on both subjective, self-report measures and objective tests of neuropsychological functioning.¹¹ Others have also found increased inattention and impulsive symptoms among college students,¹² as well as lower academic performance.¹³

NMUPS has also been linked with problematic substance use and substance use disorders (SUD).^{5,10} Multiple studies have described the co-use of prescription stimulants and other substances,^{14–16} and some have found that simultaneous use was associated with lower academic outcomes and engage in riskier behaviors.¹⁷ Additionally, NMUPS early in life has shown increased risk for later substance use and SUD. For instance, misuse of prescription stimulants in adolescence was linked to more SUD symptoms 17 years later in adulthood compared to both medical use and no use.¹³ These studies highlight the need to better understand differences between individuals who engage in NMUPS with and without co-occurring SUD.

Motivations for NMUPS among college students include improving grades, increasing productivity, staying alert or improving concentration,³ and in some cases, self-treating subthreshold or undiagnosed ADHD.^{10,12} Fewer studies report on the behaviors surrounding the acquisition and administration of stimulants among students who misuse prescription stimulants and whether these behaviors differ among different subtypes of those who endorse NMUPS. In consensus with others,^{6,18} McCabe et al. recently reported that among college students who use prescription stimulants nonmedically, 37% received stimulants at no cost from a friend or relative¹⁹ and that most used others' prescriptions.²⁰ Furthermore, most studies have found that oral administration was the most common route of

administration with a minority of students using stimulants intranasally.^{5,18,21,22} Intranasal administration of stimulants is of great concern given the potential medical complications and abuse liability^{23,24} and has previously been shown to be associated with higher rates of SUD,²¹ necessitating a more thorough understanding of this subtype of NMUPS.

We hypothesized students with co-occurring NMUPS and SUD and students who use stimulants intranasally would manifest more severe stimulant misuse and increased indices of dysfunction compared with those without SUD and those who use orally, respectively. To this end, we sought to examine the gaps in the literature by studying contextual factors associated with NMUPS among a heterogeneous sample of college students. Given the high rate of SUD among students with NMUPS, we also sought to understand the effects of the presence of SUD on the characteristics and context of NMUPS. Additionally, we sought to learn more about the subset of misusers who use stimulants intranasally, that may signify a higher-risk group of students with NMUPS.²³

METHODS

Subjects

Our current analysis is based on our assessments of 100 college students, who endorsed any nonmedical use of prescription stimulants²⁵ in the absence of a diagnosis of ADHD or a prescription for stimulant medication. Further details on the full study sample (including non-stimulant misusing controls not included in these analyses) have been described previously.¹⁰ Briefly, we used Internet advertisements to recruit males and females between the ages of 18 and 28 who were currently enrolled in local undergraduate programs in the Boston metropolitan area.

We excluded students with any major neurological, developmental, or language-based conditions that would impede the testing process, including paralysis, deafness, blindness, profound disorders of language, Autism Spectrum Disorder, inadequate command of the English language, or an estimated Full Scale IQ less than 80. The study was approved by the local institutional review board, and all subjects provided written informed consent and a federal release of confidentiality to participate in the study.

A two-stage ascertainment procedure was used to select subjects. First, subjects answered a self-report Internet screen, which we designed using the online survey creation program DatStat Illume™, a platform for electronic data capture that streamlines data collection and management and ensures data integrity and quality. Second, following recruitment, subjects were asked to complete a brief Internet screening survey on “college lifestyle.” Embedded in the lifestyle survey were the 6-item WHO screen for ADHD,²⁶ questions related to stimulant misuse, and a question regarding whether the potential subject had a diagnosis and was currently being treated for ADHD with a stimulant to determine whether subjects were eligible for the stimulant misuse group. Eligible individuals were contacted for on-site direct interview and self-report questionnaire completion. For the purpose of this study,¹⁰ NMUPS included the non-prescribed use of stimulant medications prescribed for ADHD, namely amphetamine-AMPH (dextroamphetamine, lisdexamfetamine, immediate- and extended-release mixed amphetamine salts), and immediate- and extended-release methylphenidate-

MPH but did not include use of methamphetamine or other sympathomimetic amines (e.g. cocaine, methamphetamine, MDMA).

Assessments

Our current analysis includes data from assessments that were previously conducted, but not yet reported. All diagnostic assessments were made using DSM-IV-based structured interviews by raters with bachelor's or master's degrees in psychology with extensive training and supervision from the senior investigator. Raters and reviewers were blind to the ascertainment status of probands. Psychiatric assessments for subjects relied on the Scheduled Clinical Interview Diagnosis (SCID). For every diagnosis, information was gathered regarding treatment history and the ages at onset and offset of full syndromatic criteria.

Self-report and clinician-rated measures were collected using DatStat Illume™. Participants and/or research staff entered survey responses into electronic assessment forms, and the responses were then transmitted securely via encrypted connection and stored in a secure database.

All cases were presented blindly to a committee composed of board-certified child psychiatrists and/or licensed psychologists. Diagnoses presented for review were considered positive only if the diagnosis was considered clinically meaningful due to the nature of the symptoms, the associated impairment, and the coherence of the clinical picture. All cases of suspected drug or alcohol use disorder (SUD) were further reviewed with a child and adult psychiatrist with additional addiction credentials, and moderate and/or severe SUD results were reported.

To assess the reliability of our diagnostic procedures, we previously computed kappa coefficients of agreement by having three experienced, board-certified child and adult psychiatrists diagnose subjects from audiotaped interviews made by the assessment staff. Based on 500 assessments from interviews of children and adults, the median kappa coefficient was 0.98. Kappa coefficients for individual diagnoses included: major depression (1.0), mania (0.95), ADHD (0.88), conduct disorder (CD; 1.0), oppositional defiant disorder (ODD; 0.90), antisocial personality disorder (ASPD; 0.80), and substance use disorder (1.0).

Drug Use

We evaluated NMUPS through the assessment of substance use, misuse, abuse, and dependence by structured interview, self-report Drug Use Screening Inventory (DUSI),²⁷ and query for the appropriate use of prescribed medications on the MGH ADHD Medication Misuse and Diversion Assessment,^{10,28} a self-report tool that encompasses misuse or abuse of medication, euphoria on medication, concurrent use of drugs or alcohol, and route of administration (i.e. oral, smoking, injection, intranasal, or other) over a subject's lifetime, within the past 30 days, and time while in college.²⁹ For example, "On how many occasions have you bought or traded prescription ADHD medication that was not prescribed to you? If you have never bought medication not prescribed to you, skip to the next page," and "On how many occasions have you misused your ADHD medication(s).?"

Statistical Analysis

We examined differences in demographic characteristics between students with NMUPS who met criteria for SUD and students with NMUPS who did not meet criteria for SUD. We also investigated differences between students with NMUPS and endorsed oral administration only and students with NMUPS and endorsed any intranasal use, independent of meeting SUD criteria. We used the Student's t-test for continuous outcomes, the Wilcoxon rank-sum tests for socioeconomic status (SES), and Pearson's χ^2 for binary outcomes. To examine possible differences across the MGH ADHD Medication Misuse and Diversion Assessment, we used the Student's t-test for continuous outcomes, the Wilcoxon rank-sum test for ranked responses, and the Pearson's χ^2 for binary outcomes. All statistical analyses were conducted using Stata 14.0. All tests were two-tailed with an alpha level set at 0.05 unless noted otherwise. Data are presented as mean $\pm$ standard deviation (SD) unless otherwise specified.

RESULTS

Our final sample included 100 college students with histories of NMUPS: Forty-six (46%) of subjects who endorsed NMUPS met criteria for SUD while fifty-four (54%) did not meet criteria for SUD in their lifetime. The mean age of all subjects was 20.4 years (Median: 21 years of age, 75% of the subjects were younger than 22 years old), 39% were male, and 81% were Caucasian. There were no significant differences between those who endorsed NMUPS with SUD and without SUD in age, race, SES, or gender (all p values >0.05). Additional details regarding this sample have been described previously.¹⁰

Characteristics of NMUPS

We first examined the characteristics of individuals who endorsed NMUPS who met criteria for SUD (Table 2). Students with co-occurring NMUPS and SUD reported having bought or traded more often than those without SUD across all time periods (all p values <0.05). They were also more likely to report selling or trading in the car (p=0.046).

As shown in Table 3, subjects with NMUPS and SUD endorsed using stimulants simultaneously with alcohol (p=0.004) and marijuana (p<0.001) and were more likely to use at a party (p=0.02) compared to misusers without SUD. Individuals with NMUPS and SUD were also more likely to report engaging in NMUPS to increase the effects of other drugs (p=0.007), to get more energy (p=0.003), to have a good time with friends (p<0.01), and to feel good or get high (p=0.009). Subjects with NMUPS and SUD were also more likely to report using medications intranasally compared to those without SUD (24 (52%) vs. 9 (17%), p<0.001). We found no significant difference in the type, quantity, or cost of the stimulant (all p values >0.05).

Method of NMUPS

We further examined those with NMUPS via oral administration compared to those with any intranasal administration of stimulants (Table 4). Fifty-three (62%) nonmedical users only used stimulants orally. Out of the total thirty-three (38%) individuals who endorsed intranasal use, nine (27%) only used intranasally, and 24 (73%) also used orally. Those who

reported intranasal administration reported more frequent stimulant use in their lifetime ($p=0.047$) and during college ($p=0.04$) and were more likely to use extended-release stimulants ($p=0.04$) than those who reported only oral administration. However, among students who reported intranasal administration, the rates of immediate-release vs. extended-release stimulants were similar, showing no preference for either formulation. Subjects who endorsed intranasal NMUPS were also more likely to trade stimulants for drugs ($p=0.03$), trade with an acquaintance ($p=0.02$), trade at a party ($p<0.001$), or use stimulants simultaneously with cocaine ($p=0.04$), marijuana ($p<0.001$), or alcohol ($p<0.001$).

Individuals who endorsed intranasal NMUPS were also more likely to endorse a decrease in hyperactivity in comparison to oral-only misusers ($p=0.02$). We found no significant differences in the quantity of pills that were bought or traded, cost of pills, or the stimulant used (all p values >0.05) between only oral users and those with any intranasal administration.

DISCUSSION

Data from our study indicates that the majority of college-aged students with a history of NMUPS acquired stimulants infrequently, preferred immediate-release preparations, used alone, and most commonly misused stimulants for the purpose of desired cognitive performance enhancement. Confirming our hypotheses, we found that NMUPS and co-occurring SUD was associated with a more severe form of misuse, including increased frequency of use, using stimulants in combination with other substances, and disproportionately using stimulants intranasally. Additionally, compared to those with NMUPS who used stimulants orally, those who misused intranasally engaged in riskier behaviors around stimulant misuse.

Our findings on the social context of NMUPS was in agreement with the literature^{5,18,22} We found that college students who reported NMUPS were most likely to report misusing alone or with just one or two people, as well as to use at home or at school, consistent with the finding that motives for misuse were most often academic in nature.⁶

We also found that students with NMUPS reported subjective reductions in ADHD-like cognitive symptoms as a major reason for misuse. These data, coupled with previous data showing that stimulant misusers have high rates of ADHD¹⁰ and neuropsychological dysfunction,¹¹ highlight the NMUPS for perceived pro-cognitive effects and the need to screen those who engage in NMUPS for the presence of cognitive dysfunction. Of interest, recent controlled studies suggest only a perceived, subjective cognitive enhancement effect of stimulants in those without ADHD (for review see³⁰).

We found that most individuals endorsed only oral administration of stimulants; however, we also found that a large minority endorsed using stimulants intranasally (38%). Our findings are similar to others who reported that from 17% to 39% of stimulant misuse was intranasally administered.^{5,18,22,31} Unlike others, we did not find that any participants smoked or used other methods of administration.²² That may be due to the relatively small size of our sample or cultural differences among college campuses. Important differences

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were also noted for those who reported intranasal NMUPS. Those who reported intranasal administration were more likely to use extended-release preparations than those who only reported oral administration. It is important to note that among participants who used stimulants intranasally, we found similar rates of use of extended- and immediate-release stimulants. This apparent lack of preference for either preparation intranasally could be due to a change in effect of extended-release medication when administered intranasally, availability of extended-release preparations, or other undetermined reasons. However, we have yet to fully understand the reasons and consequences of this route of administration of extended- vs. immediate-release stimulants. Furthermore, students who used stimulants intranasally were more likely than oral users to acquire stimulants from an acquaintance or at parties or to trade other drugs for stimulants. They were also more likely to co-use with cocaine, marijuana, or alcohol. These findings suggest that intranasal administration could be a marker for more risky behavior around NMUPS.

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The aggregate literature showing high rates of intranasal NMUPS is of great concern given the higher abuse liability,²³ cardiovascular effects,²³ and higher rates of SUD²¹ linked to intranasal use relative to oral use. Notably, Faraone and Hess recently found that misusers who used amphetamine intranasally were at greater risk of admission in a health care facility, adverse clinical effects, and death than those who misused orally.³² Consideration of more abuse-deterrent systems of stimulant preparations negating intranasal routes of administration is necessary to reduce this common yet potentially dangerous route of misuse.

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Nearly one-quarter of misusers noted misusing stimulants simultaneously with either alcohol or marijuana in order to create overlapping effects (i.e., simultaneous co-ingestion)—similar to other studies reporting similar behavior in from 19% to 41% of college students.^{14–16} Additionally, higher rates of SUD¹⁵ and an increase in emergency department admissions have been noted in this group^{33,34} highlighting the potential serious adverse effects in the context of co-using stimulants and other substances of misuse.

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Multiple studies have demonstrated consistently high rates of SUD in NMUPS.^{5,10,21} Our data showed that misusers with compared to without SUD had important characteristics associated with their misuse: Individuals with NMUPS and SUD were more likely to use stimulants intranasally, co-ingest with alcohol or marijuana, and acquire stimulants more frequently than those without SUD. Not surprisingly, these characteristics suggest a more severe phenotype of NMUPS associated with SUD. Previous studies have found more non-oral administration, increased substance use,¹⁶ and lower academic performance¹⁷ in adolescents and young adults with NMUPS who reported past year co-use of stimulants and drugs or alcohol. Given the high overlap of SUD in NMUPS, more work is necessary to better understand translationally the short- and longer-term implications of SUD in NMUPS.

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Having a thorough understanding of the habits of college students with NMUPS may aid in the creation of prevention and intervention programs, as well as university policies addressing NMUPS on campus. Our findings on the behaviors and motivations for NMUPS add to increasing evidence^{3,6,18,35} that stimulants are largely being misused for academic reasons. The identification of different subtypes of NMUPS found in our study will further

aid clinicians in diagnosing and treating college-aged patients. A nuanced understanding of these distinct behavioral patterns may assist clinicians in assessing the severity of misuse, as well as in making informed decisions regarding future prescriptions. For example, evaluating method of misuse may provide insight into the likelihood of other risky behavior and other substance use. Regarding treatment, practitioners may find that a different treatment plan is more acceptable for patients engaging in NMUPS with and without SUD. Whereas patients without SUD may require increased academic support and increased education on the risks of stimulant misuse, those with SUD will most likely require more consistent medical care, directed to their SUD.

There are a number of methodological limitations of the current study. Our sample size is relatively small and represents the environment of NMUPS in one northeast metropolitan area, and as such, may not generalize to other areas or college-aged subjects. Additionally, we chose not to control for multiple comparisons and the sample was too small to conduct any multivariable analyses to rule out potential confounders or to run an AUC-ROC curve to determine at what point these characteristics differentiate these two groups. Broader research in more geographically diverse college settings is necessary to further validate our findings. Additionally, the self-reported surveys we used required participants to recall information retrospectively; thus, subjects may have underreported or inaccurately recalled past events on the questionnaires. There are limits to the details (e.g. motivations for different form of administration) captured in a questionnaire, and our study is cross-sectional, and thus, our results can only be interpreted as associative.

Despite these limitations, the data presented here add to previous work demonstrating the increased adverse impact of concurrent SUD and/or intranasal NMUPS. Our data support prior findings that misusers frequently use stimulants for desired performance enhancement and are securing stimulants largely from friends. Intranasal use of stimulants occurs in a sizeable minority of college students with NMUPS, and there is a disproportionate misuse of immediate- relative to extended-release stimulants. These data highlight the continued need to educationally target practitioners and college students to reduce the diversion and misuse of stimulants in college settings.

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Declaration of Interest:

MaryKate Martelon, M.S., Tamar Kaminski, B.S., Ty S. Schepis, Ph.D., and Sean Esteban McCabe, Ph.D.: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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Timothy Wilens, M.D.: Dr. Timothy Wilens is Chief, Division of Child and Adolescent Psychiatry and (Co) Director of the Center for Addiction Medicine at Massachusetts General Hospital. He receives grant support from the following sources: NIH (NIDA). Dr. Wilens has published a book, *Straight Talk About Psychiatric Medications for Kids* (Guilford Press), and co/edited books: *ADHD in Adults and Children* (Cambridge University Press), *Massachusetts General Hospital Comprehensive Clinical Psychiatry* (Elsevier), and *Massachusetts General Hospital Psychopharmacology and Neurotherapeutics* (Elsevier). Dr. Wilens is co/owner of a copyrighted diagnostic questionnaire (Before School Functioning Questionnaire) and has a licensing agreement with Ironshore (BSFQ Questionnaire). He is or has been a consultant for Kempharm, Otsuka, and Ironshore, and serves as a clinical consultant to the US National Football League (ERM Associates), U.S. Minor/Major League Baseball; Gavin Foundation and Bay Cove Human Services.

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Table 1.

Demographics of Subjects With Lifetime NMUPS With and Without Endorsement of Lifetime SUD (N=100)

	NMUPS without SUD (N=54)	NMUPS with SUD (N=46)	Test Statistic	p-value
	Mean $\pm$ SD	Mean $\pm$ SD		
Age	20.41 $\pm$ 1.6	20.93 $\pm$ 1.70	t=-1.60	0.11
SES ^a	2.0 $\pm$ 1.1	1.9 $\pm$ 0.95	z=0.30	0.77
	N (%)	N (%)		
Gender (% male)	21 (39)	26 (57)	$\chi^2=3.1$	0.08
Race (% Caucasian)	44 (81)	40 (87)	$\chi^2=0.55$	0.46

Unless otherwise noted, subjects reported NMUPS during the past 30 days, college, or their lifetime.

^a 6 subjects were missing SES information (range: 1–5, overall mean: 1.96)

Table 2.
Comparison of NMUPS With and Without Endorsement of Lifetime SUD (N=100)

Frequency Bought and/or Traded	NMUPS without SUD				NMUPS with SUD			
	N=51				N=44			
	Never	1–5 times	6–20 times	20+ times	Never	1–5 times	6–20 times	20+ times
College (N=95) *	8 (16%)	33 (65%)	8 (16%)	2 (4%)	5 (11%)	21 (48%)	15 (34%)	3 (7%)
Past 30 days (N=88) *	36 (80%)	9 (20%)	0 (0%)	0 (0%)	23 (54%)	19 (44%)	1 (2%)	0 (0%)
Lifetime (N=91) *	6 (12%)	30 (63%)	11 (23%)	1 (2%)	2 (5%)	23 (53%)	12 (28%)	6 (14%)
Amount Purchased (per occasion)	N=50				N=42			
1–5 Pills			43 (86%)				33 (79%)	
6–10 Pills			2 (4%)				3 (7%)	
11–20 Pills			3 (6%)				6 (14%)	
Cost of tablets/capsules (in US dollars)			N=54				N=46	
			3.3 ± 2.8				3.8 ± 3.3	
Where Bought and/or Traded			N=54				N=46	
Dorm			37 (80%)				42 (78%)	
Car *			11 (24%)				5 (9%)	
Public			12 (26%)				8 (15%)	
Party			10 (22%)				6 (11%)	
Bought/traded stimulant preparation			N=54				N=46	
Immediate-release			38 (70%)				32 (70%)	
Extended-release			26 (48%)				27 (59%)	
Nonmedical prescription stimulants used (past year)			N=54				N=46	
<i>Immediate Release</i>								
Adderall			29 (54%)				20 (43%)	
Ritalin			6 (11%)				11 (24%)	
Other (Focalin, Dexedrine)			1 (2%)				3 (6%)	
<i>Extended Release</i>								
Adderall XR			14 (26%)				15 (33%)	

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	5 (11%)	3 (6%)	Other (Ritalin LA, Focalin XR, Daytrana Patch, Dexedrine Spansule and Metadate CD)
	4 (9%)	7 (13%)	
	9 (20%)	9 (17%)	
	NMUPS with SUD	NMUPS without SUD	
Concerta			
Vyvanse			

Unless otherwise noted, subjects reported NMUPS during the past 30 days, college, or their lifetime. Not all subjects provided answers to all questions, therefore the Ns are noted for each question.

*
p<0.05

Table 3.

Comparison of NMUPS Characteristics With and Without Endorsement of Lifetime SUD (N=100)

	NMUPS without SUD (N=54)	NMUPS with SUD (N=46)
NMUPS in Conjunction With	N=48	N=38
Alcohol *	12 (25%)	21 (55%)
Marijuana *	7 (15%)	20 (53%)
Cocaine	2 (4%)	3 (8%)
Social Context of NMUPS	N=48	N=38
Alone	34 (71%)	28 (74%)
With one or two people	23 (63%)	22 (58%)
At a party *	9 (19%)	16 (42%)
With a partner	4 (8%)	8 (21%)
When people over 30 years of age are present	9 (19%)	9 (24%)
Daytime (before 4 pm)	28 (58%)	28 (74%)
At home	37 (77%)	31 (82%)
At school	32 (67%)	26 (68%)
In a car	1 (2%)	4 (11%)
Reason for NMUPS	N=54	N=46
To stay awake	30 (56%)	31 (67%)
To increase the effects of other drugs *	1 (2%)	8 (17%)
To reduce distraction	33 (61%)	22 (48%)
To get more energy *	18 (33%)	29 (63%)
To experiment - to see what it's like	21 (39%)	21 (46%)
To have a good time with my friends *	3 (6%)	19 (41%)
To feel good or get high *	6 (11%)	15 (33%)
To get through the day	6 (11%)	6 (13%)
To relax or relieve tension	3 (6%)	4 (8%)
To seek deeper insights/understandings	2 (4%)	4 (8%)
To fit in with a group	2 (4%)	1 (2%)
To lose weight	5 (9%)	2 (4%)
To help concentrate/focus better	42 (78%)	35 (76%)
Other (To help settle down, to get away from problems or troubles, boredom)	3 (6%)	7 (15%)
Route of NMUPS	N (%)	N (%)
Oral	42 (78%)	35 (76%)
Intranasal *	9 (17%)	24 (52%)

Unless otherwise noted, subjects reported NMUPS during the past 30 days, college, or their lifetime. Not all subjects provided answers to all questions, therefore the Ns are noted for each question.

* $p < 0.05$

Table 4.

Comparison of NMUPS Characteristics among those who administered Intranasally and Orally and those who only administered Orally (N=86)

	Oral Administration ^a (N=53)	Intranasal Administration ^b (N=33)	Test Statistic	p-value
Frequency of Acquiring Stimulant Medications	Mean ± SD	Mean ± SD		
Lifetime (0 to 3) ^c	1.3 ± 0.6	1.6 ± 0.9	$z=-.199$	0.047
College (0 to 3) ^c	1.2 ± 0.6	1.5 ± 0.8	$z=-2.1$	0.04
Past 30 days (0 to 3) ^c	0.4 ± 0.5	0.4 ± 0.5	$z=-0.45$	0.65
Substances used in conjunction with stimulants				
Alcohol (0 to 4) ^d	0.3 ± 0.6	1.1 ± 0.9	$z=-4.6$	<0.0001
Marijuana (0 to 4) ^d	0.2 ± 0.4	1.2 ± 0.4	$z=-4.41$	<0.0001
Cocaine (0 to 4) ^d	0.04 ± 0.3	0.17 ± 0.5	$z=-2.1$	0.04
Location of sale/trade of Stimulant Medications	N (%)	N (%)		
Dorm	44 (83)	28 (85)	$\chi^2=0.05$	0.82
Car	6 (11)	9 (27)	$\chi^2=3.6$	0.06
Public Place	9 (17)	10 (30)	$\chi^2=2.1$	0.15
Party	3 (6)	12 (36)	$\chi^2=13.3$	<0.001
Person for whom who bought/traded				
Friend	47 (89)	30 (91)	$\chi^2=0.11$	0.74
Family	4 (8)	3 (9)	$\chi^2=0.06$	0.8
Acquaintance	9 (17)	13 (39)	$\chi^2=5.4$	0.02
Stranger	0 (0)	1 (3)	$\chi^2=1.6$	0.2
Bought/traded stimulant preparation				
Immediate Release	38 (72)	24 (73)	$\chi^2=0.01$	0.92
Extended Release	25 (47)	23 (70)	$\chi^2=4.2$	0.04
Substances exchanged for stimulants				
Drugs	2 (4)	6 (18)	$\chi^2=5.0$	0.03
Alcohol	2 (4)	5 (15)	$\chi^2=3.5$	0.06
Stimulants	1 (2)	1 (3)	$\chi^2=0.12$	0.73
Medication	2 (4)	1 (3)	$\chi^2=0.03$	0.86

Unless otherwise noted, subjects reported NMUPS during the past 30 days, college, or their lifetime.

^a“Oral Administration” denotes subjects who only engaged in oral use of stimulants

^b“Intranasal Administration” denotes subjects with concomitant oral use (n=24) and misusers who only misused intranasally (n=9)

^cScale: 0 = Never, 1 = 1–5 times, 2 = 6–20 times, and 3 = 20+ times

^dScale: 0 = Not at all, 1 = A few times, 2 = Sometimes, 3 = Most of the time, 4 = Every time

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