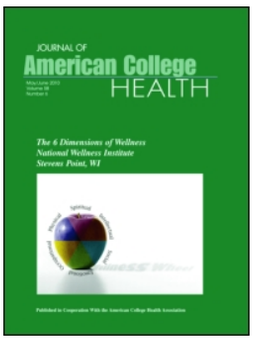

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MAJOR ARTICLE

Prescription stimulant use among young adult college students: Who uses, why, and what are the consequences?

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ABSTRACT

Objective: To examine prescription stimulant use among college students, particularly use with versus without prescriptions or attention deficit hyperactive disorder (attention-deficit/hyperactivitydisorder (ADHD)) diagnoses. **Participants:** Data were drawn from a diverse sample of college students from seven colleges/universities in Georgia participating. **Methods:** Measures assessed ADHD-specific factors, prescription stimulant use, access, motives, side effects, and covariates. **Results:** Of the 219 students reporting prescription stimulant use (average age 20.72 years, 54.8% female, 82.1% White), 45.7% did not have prescriptions or ADHD diagnoses. Correlates of use without prescriptions/diagnoses included lower parental education, attending private school, not having depression- or anxiety-related diagnoses, and past 30-day marijuana and tobacco use. Those without prescriptions/diagnoses were more likely to use to stay awake longer, to have more enjoyable time, and to party longer; they also reported fewer adverse side effects. **Conclusions:** Campuses should educate students about ADHD, facilitate screening and treatment, and emphasize adverse consequences of recreational use.

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college students; motives for use; prescription stimulants; stimulants; young adults

Introduction

Prescription stimulants (PS) are commonly used to treat Attention Deficit Hyperactivity Disorder (ADHD). ADHD is a mental health condition that affects nearly 6.1% of children and 3.6% of adults in the US, with prevalence increasing over the past 30 years.[1–4] The use rates of PS is higher in the US compared to any other country, accounting for 83.1% of global PS medication consumption.[5]

PS use is a particularly relevant issue among college students. A 2012 study indicated that approximately 8.1% of college students were prescribed PS medication for ADHD in the past year.[6] However, college students' use of PS without a prescription (or nonmedical prescription stimulant use [NMPS]) has become an increasingly prevalent public health problem. For example, one study[7] showed that, in a national sample of 900 students, 9.8% of college-aged people used PS that were not prescribed to them during the past 30 days. Similarly, another study[8] found that, in a sample of 8,039 full-time undergraduate students, 11.2% of the sample engaged in NMPS use in the past six months. Data from Monitoring the Future indicates that NMPS use by college students peaked in 2012 with 11.1% of respondents reporting using NMPS.[9]

These statistics are concerning because of a range of consequences. For example, the Substance Abuse and Mental Health Services Administration (SAMHSA) reported recent increases in emergency department visits related to PS, from 13,379 in 2005 to 31,244 in 2013.[10] Of these PS-related emergency department visits, 50% were due to NMPS use, 29% were due to adverse reactions, and the remaining 21% were due to either suicide attempts or accidental ingestion.[10] With regard to the latter, PS are typically consumed orally; however, NMPS users might ingest PS through snorting, smoking, inhaling or injecting PS,[11] which raises concerns given that the form of ingestion may alter PS pharmacokinetics and increase the risk of dependence.[12]

Among PS used to treat ADHD, Adderall and Ritalin are the two most common among college students.[7] Nearly 75% of college students that use PS report using Adderall, with 17% using Ritalin, and others using undisclosed stimulants.[13] This is a shift from before 2006, when Ritalin was the most used PS.[11] This shift may be due to adverse side effects of these earlier PS and pharmaceutical industry efforts to reduce such effects. Adderall may have become the stimulant of choice because of the extended release, lower occurrence of "ups and downs," as well as the higher rate of prescriptions.[11] Users also believe that Adderall causes fewer emotional ups and downs and generally works better.[11] Despite pharmaceutical advances in PS development, side effects of PS use continue to include sleeplessness, heart papulations, racing thoughts, and anxiety.[14]

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The literature has documented that academic performance is a prominent motive for NMPS use. For example, one of the most commonly reported reasons for NMPS use is to improve concentration and to improve academic performance.[15] Of NMPS users, approximately 51% use PS to stay awake, 81% to study, 54% to help with academics, and 40% to increase alertness.[16] Students with lower grade point averages are more likely to engage in NMPS use because they feel the need to stay awake and alert in order to catch up in their academic performance, complete coursework, and study for exams.[17] This may be related to the fact that NMPSU rates have been shown to be associated with more selective college admission criteria.[17,18]

The current study utilizes the Socioecological Model (SEM) and the Social Cognitive Theory (SCT) to pursue our research questions. The SEM highlights multiple levels of influence on a behavior or outcome, including individual, interpersonal, community, and societal levels.[19] The use of the SCT allows for the assessment of cognitive influences, environmental influences, and supporting behavioral factors on health behaviors.[20] SCT is particularly relevant, as it highlights the importance of outcome expectations. Such expectancies as motives for use (e.g., academic reasons) and adverse consequences (e.g., side effects of use) are key in characterizing NMPS use.

These theoretical frameworks are important because individual, interpersonal, and behavioral factors are key correlates of NMPS use. For example, NMPS use has been associated with sociodemographic characteristics, psychosocial factors, and other substance use.[11,17,18,21] Regarding sociodemographic characteristics, for example, Whites demonstrate higher rates of NMPS use, compared to being Black, Asian, or Hispanic.[17,21] In terms of psychosocial factors, adverse childhood events (ACEs) have been shown to be associated with PS and NMPS use.[22] In addition to ACEs, depression has been found to be associated with NMPS use, as well as misuse of prescription drugs more broadly.[23] Research has indicated that those who misuse PS, compared to those who do not misuse PS, are more likely to feel sad, depressed, and consider suicide.[24] Moreover, those who use PS and have significant ADHD symptoms may have greater rates of alcohol, tobacco, and other drug use.[25] A 2009 study indicated that 98% of NMPS users used alcohol in the past six months, 50% used cigarettes, 74% used marijuana, and 25% used cocaine.[21] A more recent study[26] reported that 95.3% of NMPS users report the use of at least one illicit drug. Another study[27] found that 26% of NMPS users have either a drug or alcohol dependency or both, which is higher than their non-using peers. Additionally, NMPS use may be associated with increased risk of polydrug use.[28]

Other factors at the broader community-level, such as school type or rural or urban setting, may also be important correlates. In addition, and particularly relevant to the current study, college students in the southern region of the US are more likely to report using PS and are more likely to report NMPS use compared to students in the western and north central regions in the US,[17] but less likely compared to the northeastern region of the US.[7]

Though PS use is widely studied among college students, few studies examine PS use in the southern US, and almost no studies examine correlation among diverse types of post-secondary institutions. In examining PS use among college and university students, the current study aimed to: 1) characterize students using PS; 2) characterize PS use, reasons for use, and adverse outcomes related to use among PS users; and 3) examine correlates of use of PS without a prescription or diagnosis of ADHD.

Methods

Procedures

These analyses used data from Project DECOY (Documenting Experiences with Cigarettes and Other Tobacco in Youth), a quantitative, longitudinal assessment of data regarding tobacco use among college students. This two-year longitudinal cohort study involves 3,418 young adults attending seven Georgia colleges and universities, which includes two public universities, two private universities, two technical/community colleges, and a historically black college and university. These campuses were selected to obtain a broad range of young adults in terms of sociodemographic backgrounds. Project DECOY was approved by the Emory University Institutional Review Board (IRB) (IRB00069042) as well as those of ICF and the participating colleges and universities. Informed consent was obtained from all participants in the research.

College email addresses were obtained from the registrar's office from each college or university for students meeting eligibility criteria (i.e., age 18 to 25-year old, ability to read English). Three thousand 18 to 25-year old students were selected randomly from one private and 2 public universities. The remainder of the schools had 18 to 25-year-old student populations of less than 3000; thus, the entire student population of that age range at those schools was included in recruitment. Response rates varied, with a total response rate of 22.9% (n = 3574/15,607). Seven days after initial recruitment and completion of the baseline survey, we asked participants to confirm their participation by clicking a "confirm" button included in an email sent to them. The confirmation rate was 95.6% (n = 3418/3574).

Data collection began in Fall 2014 and consisted of individual assessments every four months for the duration of two years (during Fall, Spring, and Summer). Current analyses focused on those participants who completed Wave 2 assessments (Spring 2015; n = 2,969, 86.9% of the baseline sample) who also had complete data for the analyses (n = 2,927, 98.6% of the Wave 2 participants). Subsequently, analyses focused on those participants who reported any use of PS in the past 4 months (n = 219, 7.5% of the analytic sample).

Measures

The survey assessed ADHD symptoms and diagnosis and factors related to PS use, as well as sociodemographic characteristics, psychosocial factors, and substance use behaviors.

ADHD-specific factors

Single items were used to assess past 4-month PS use and having a diagnosis of ADHD at Wave 2. *Past 4-month use of PS* was assessed by asking, "How many days in the past 4 months have you used prescription ADHD stimulants such as Ritalin, Concerta, Metadate, Dexedrine, Vyvanse, Adderall, Cocaine, Methamphetamine, or Amphetamine Methedrine?" *Having a diagnosis of ADHD* was assessed by asking, "Has any healthcare provider ever told you that you have ADD or ADHD?"

ADHD symptoms were measured at Wave 2 utilizing the six-item Adult ADHD Self-Report Scale Symptom Checklist.[29] Participants are asked to respond to each item (e.g., "how often do you feel overly active and compelled to do things?") on a five-point Likert-type scale (0 = never to 4 = very often). Total scores range from 0 to 24, with higher scores indicating more symptoms of ADHD. Cronbach's alpha in the present study was .74.

PS use

Single items were used to assess type of PS used, mode of use, access to PS, motives for use, and side effects of use at Wave 2. *The type of PS used* was assessed by asking, "In the past 4 months, what type of stimulant did you use most often? Amphetamine, Methylphenidate (Ritalin, Concerta, Metadate), Dexmethylphenidate (Focalin), Dextroamphetamin (Dexedrine), Lisdextroamphetamine (Vyvanse), Mixed Amphetamine salts (Adderall), Other, Refuse." *Mode of PS use* was assessed by asking, "Which of the following ways did you consume stimulants: orally? snorting? smoking? inhaling? other? refuse." *Access to PS* was assessed by asking, "How did you obtain the stimulant(s) you took? (Check all that apply.) It was prescribed to me by a healthcare provider, I bought it online, I bought it from someone, someone gave it to me, other, or I don't know." Participants were also asked, "Have you ever: Been approached for prescription stimulants? Shared prescription stimulants for free? or Shared prescription stimulants for money?" *Motives for PS use* was assessed by asking, "For which of the following reasons did you take stimulants: Because it was prescribed for my ADHD, To help me be less bored by work, To help me be more productive with my schoolwork, To help me concentrate better, To help me stay awake longer or all night, To help me feel more focused, To help me get my work done more efficiently, To make me feel less distracted, To make me feel more sociable and outgoing, To make me have a more enjoyable time, To make people feel more energetic, To make me feel happier and more content, To make me feel less hunger, To help me lose weight, or To be able to party longer." *Side effects of PS use* were assessed by asking, "Indicate if you have had any of these problems as a result of taking stimulants: Difficulty falling asleep, Difficulty staying asleep, Poor sleep quality, Headaches, Heart palpitations, Fidgety feeling, Feeling too focused on something, Feeling anxious, Feeling jittery and shaky, Not feeling hungry, and Feeling like I need to crash after taking them."

Covariates

Sociodemographic factors included in the current analyses included age, sex, sexual orientation, race, ethnicity, and parental education (as a proxy for socioeconomic status (SES)). We also included the type of college or university attended as well as location (e.g., rural or urban area).

To assess *adverse childhood events (ACEs)*, participants were asked 10 items from the Centers for Disease Control and Prevention (CDC)-developed assessment from the Behavioral Risk Surveillance Survey (Centers for Disease Control and Prevention (CDC), National Center of Injury Prevention and Control), administered at Wave 2. These items assess stressful or traumatic experiences (e.g., physical and sexual violence, parental mental health, parental substance use, childhood maltreatment) experience before age 18 (0 = no, 1 = yes). Scores range from 0 to 10, with higher scores indicating more adverse events experienced. Cronbach's alpha in the present study was .75. *Depressive symptoms* were assessed at Wave 5 using the Patient Health Questionnaire – 9 (PHQ-9 scale),[30] in which participants are asked how often in the past two weeks they experienced symptoms such as "little interest or pleasure in doing things" or "feeling bad about yourself or that you are a failure or have let yourself or your family down" using a four-point Likert-type scale (0 = not at all to 3 = nearly every day). Total scores range from 0 to 27, with higher scores indicating more depressive symptoms. Cronbach's alpha in the current study was .87.

Single items were used to assess other mental health diagnoses and substance use. *Having diagnoses of depression and anxiety* was assessed at Wave 2 by asking, "Has any healthcare provider ever told you that you have: depression? anxiety disorder?" *Substance use* was assessed by asking the number of days of use in the past 30 days of the following: alcohol, marijuana, cigarettes, little cigars/cigarillos, smokeless tobacco, e-cigarettes, and hookah. These items were operationalized as current (past 30-day) use of alcohol, marijuana, or any tobacco, respectively.

Data analysis

Descriptive statistics were conducted to characterize the sample. We then conducted bivariate analyses examining differences between PS users versus non-users and between users who had a diagnosis of ADHD or prescription for their stimulant versus those who did not. We then conducted multivariable logistic regression comparing these two groups (i.e., users who had a diagnosis of ADHD or prescription for their stimulant versus those who did not), first entering only sociodemographic factors and then including psychosocial factors and substance use. We then characterized types of PS used, modes of use, access, reasons for use, and adverse side effects of use among users and examined differences with regard to these factors between users who had a diagnosis of ADHD or prescription for their stimulant versus those who did not. All analyses were done in SPSS 24.0.

Results

Participant characteristics

Table 1 displays characteristics of participants in the sample. Of note, 7.0% (n = 205) reported a diagnosis of ADHD, and 7.5% (n = 219) reported use of PS in the past 4 months. Among PS users, 54.3% (n = 119) reported they were either diagnosed with ADHD (43.8%, n = 96) and/or prescribed PS (51.6%, n = 113).

Correlates of PS use (versus no use; Table 1) included being male ($p = .002$), being a sexual minority ($p = .040$), higher parental education ($p = .011$), being in a rural environment ($p = .001$), having a higher GPA ($p = .033$), having higher ACEs scores ($p = .001$), having greater depressive and/or ADHD symptoms ($p's < .001$), being diagnosed with depression and/or anxiety ($p's < .001$), and past 30-day use of alcohol, marijuana, and/or tobacco ($p's < .001$). There were significant differences in race ($p < .001$) and school type ($p < .001$) in relation to no PS use versus use.

PS use characteristics

Average age at first PS use among PS users was 15.8 (SD = 5.5). The most often used stimulant was mixed amphetamine salts (Adderall) (42.9%), followed by lisdextroamphetamine (Vyvanse) (27.4%) and methylphenidate (Ritalin, Concerta, Metadate) (13.2%). Most common modes of

Table 1. Participant characteristics and bivariate analyses examining correlates of prescription stimulant use.

		Use			Prescribed or diagnosed		
	All N = 2927 M (SD) or N (%)	No n = 2708 M (SD) or n (%)	Yes n = 219 M (SD) or n (%)	*p*	Yes n = 119 M (SD) or n (%)	No n = 100 M (SD) or n (%)	*p*
ADHD factors							
ADHD diagnosis, n (%)							
No	2722 (93.0)	2599 (96.0)	123 (56.2)		–	–	
Yes	205 (7.0)	109 (4.0)	96 (43.8)		–	–	
ADHD symptoms, M (SD)	9.53 (4.37)	9.34 (4.28)	11.74 (4.84)	<.001	12.79 (4.81)	10.50 (4.60)	<.001
Sociodemographics							
Age, M (SD)	20.54 (1.94)	20.52 (1.93)	20.72 (2.0)	.158	20.92 (2.067)	20.47 (1.915)	.095
Sex, N (%)				.002			.020
Male	1034 (35.3)	935 (34.5)	99 (45.2)		45 (37.8)	54 (54.0)	
Female	1893 (64.7)	1773 (65.5)	120 (54.8)		74 (62.2)	46 (46.0)	
Sexual orientation, n (%)				.040			.409
Heterosexual	2663 (91.8)	2471 (92.1)	192 (88.1)		106 (89.9)	86 (86.0)	
Other	237 (8.2)	211 (7.9)	26 (11.9)		12 (10.1)	14 (14.0)	
Race, n (%)				<.001			.092
White	1882 (65.1)	1703 (63.7)	179 (82.1)		99 (83.9)	80 (80.0)	
Black	655 (22.7)	641 (24.0)	14 (6.4)		6 (5.1)	8 (8.0)	
Asian	184 (6.4)	177 (6.6)	7 (3.2)		1 (0.8)	6 (6.0)	
Other	170 (5.9)	152 (5.7)	18 (8.3)		12 (10.2)	6 (6.0)	
Ethnicity, n (%)				.295			.501
Non-Hispanic	2682 (92.2)	2485 (92.3)	197 (90.4)		106 (89.1)	91 (91.9)	
Hispanic	228 (7.8)	207 (7.7)	21 (9.6)		13 (10.9)	8 (8.1)	
Parental education, n (%)				.011			.167
< Bachelors	1368 (47.3)	1283 (48.0)	85 (39.0)		41 (34.7)	44 (44.0)	
≥ Bachelors	1522 (52.7)	1389 (52.0)	133 (61.0)		77 (65.2)	56 (56.0)	
School Type, n (%)				<.001			.167
Private	1217 (41.6)	1105 (40.8)	112 (51.1)		55 (46.2)	57 (57.0)	
Public	817 (27.9)	752 (27.8)	65 (29.7)		33 (27.7)	32 (32.0)	
Technical college	572 (19.5)	532 (19.6)	40 (18.3)		30 (25.2)	10 (10.0)	
HBCU	321 (11.0)	319 (11.8)	2 (0.9)		1 (0.8)	1 (1.0)	
Rural/urban, n (%)				.001			1.00
Rural	1378 (47.1)	1250 (46.2)	128 (58.4)		70 (58.8)	58 (58.0)	
Urban	1549 (52.9)	1458 (53.8)	91 (41.6)		49 (41.2)	42 (42.0)	
Psychosocial factors							
GPA, M (SD)	2.37 (1.02)	2.35 (1.01)	2.52 (1.06)	.033	1.02 (.10)	2.46 (.12)	.463
ACEs, M (SD)	1.3 (1.94)	1.26 (1.77)	1.71 (2.09)	.001	1.84 (.17)	2.36 (.24)	.524
Depressive symptoms, M (SD)	14.5 (5.26)	14.30 (5.12)	16.86 (6.35)	<.001	6.57 (.60)	6.10 (.61)	.467
Depression diagnosis, n (%)				<.001			<.001
No	2595 (88.7)	2444 (90.3)	151 (68.9)		68 (57.1)	83 (83.0)	
Yes	332 (11.3)	264 (9.7)	68 (31.1)		51 (42.9)	17 (17.0)	
Anxiety diagnosis, n (%)				<.001			.001
No	2606 (89.0)	2446 (90.3)	160 (73.1)		76 (63.9)	84 (84.0)	
Yes	321 (11.0)	262 (9.7)	59 (26.9)		43 (36.1)	16 (16.0)	
Substance use, past 30 day							
Alcohol, n (%)				<.001			.003
No	1096 (37.4)	1066 (39.4)	30 (13.7)		24 (20.2)	6 (6.0)	
Yes	1831 (62.6)	1642 (60.6)	189 (86.3)		95 (79.8)	94 (94.0)	
Marijuana, n (%)				<.001			<.001
No	2462 (86.2)	2343 (88.5)	119 (56.7)		85 (73.3)	34 (36.2)	
Yes	395 (13.8)	304 (11.5)	91 (43.3)		31 (26.7)	60 (63.8)	
Tobacco, n (%)				<.001			<.001
No	2265 (77.4)	2159 (79.7)	106 (48.4)		74 (62.2)	32 (32.0)	
Yes	662 (22.6)	549 (20.3)	113 (51.6)		45 (37.8)	68 (68.0)	

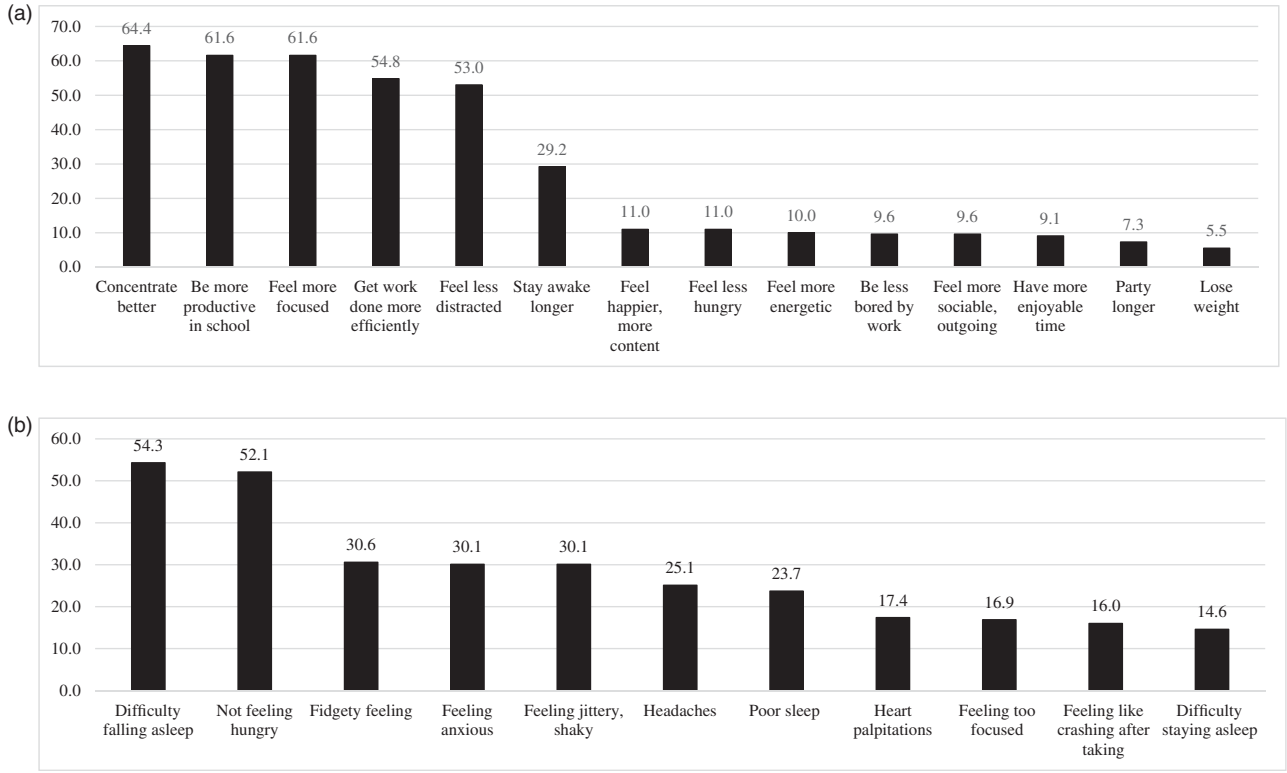

Figure 1. Reasons for taking stimulants and problems associated with taking stimulants, n = 219. (a) Reasons for taking stimulants; (b) problems associated with taking stimulants.

consuming stimulants were oral consumption (91.8%) and snorting (12.3%). In terms of the methods in which stimulants are obtained, 44.3% reported being prescribed the stimulant, 30.1% were given the stimulant by someone, 17.8% bought the stimulant from someone, and 6.4% bought PS online. When asked if they had ever been approached for stimulants, 35.6% of respondents said yes, 19.6% reported sharing stimulants for free, and 9.1% reported sharing their stimulants for money.

The top five reasons for stimulant use (Figure 1a) were to be more productive with schoolwork (61.6%), to concentrate better (64.4%), to feel more focused (61.6%), to get work done more efficiently (54.8%), and to feel less distracted (53.0%). The average number of reasons for use was 3.93 (SD = 3.00). In terms of adverse experiences related to PS use (Figure 1b), users of PS faced problems such as difficulty falling asleep (54.3%), not feeling hungry (52.1%), feeling fidgety (30.6%), feeling anxious (30.9%), or feeling jittery and shaky (30.9%). The average number of adverse effects of PS use was 3.11 (SD = 2.77).

Correlates of PS use without an ADHD diagnosis or prescription

Correlates of PS use without a prescription or diagnosis (shown in Table 1) included being male ($p = .020$), being diagnosed with depression ($p < .001$) and/or anxiety ($p = .001$), and past 30-day use of alcohol ($p = .003$), marijuana ($p < .001$), and/or tobacco ($p < .001$).

In the multivariable model examining correlates of use of PS without an ADHD diagnosis or without a prescription for the stimulant (Table 2), significant correlates included: lower parental education ($p = .008$), attending a private school compared to attending a technical college ($p = .032$; but no differences between public and private college students), not being diagnosed with depression ($p = .014$) and/or anxiety ($p = .033$), and past 30-day use of marijuana ($p = .008$) and/or tobacco ($p = .015$).

With regard to use characteristics, motives for use, and adverse effects of use, few differences were identified between users who had a diagnosis of ADHD or prescription for their stimulant versus those who did not. Those not diagnosed or not prescribed their PS (compared to those with an ADHD diagnosis or prescription) were older at the time of first using PS (M = 16.75, SD = 5.59 vs. M = 15.07, SD = 5.40, $p = .025$) and were more likely to indicate that they snorted their PS (5.9% vs. 20.0%, $p = .001$). Those not diagnosed with ADHD or not prescribed their PS were more likely than those with a diagnosis or prescription to indicate reasons for use including "to stay awake" (46.0% vs. 15.1%, $p < .001$), "to have a more enjoyable time" (15.0% vs. 4.2%, $p = .005$), and "to party longer" (13.0% vs. 2.5%, $p = .003$). They were also less likely to report the following adverse effects: difficulty falling asleep (46.0% vs. 61.3%, $p = .016$), headaches (19.0% vs. 30.3%, $p = .039$), feeling fidgety (24.0% vs. 36.1%, $p = .036$), feeling anxious (21.0% vs. 37.8%, $p = .005$), and not feeling hungry (43.0% vs. 59.7%, $p = .010$).

Discussion

This study used SEM and SCT to characterize PS use among students from diverse institutions in Georgia. In our sample, 7.0% reported a diagnosis of ADHD, slightly higher than the

Table 2. Multivariable regression analyses examining correlates of prescription stimulant use without a prescription or diagnosis, n = 219.

	OR	CI	p
Sociodemographics			
Age	0.93	0.77–1.12	.412
Sex			
Male	Reference	–	–
Female	0.81	0.37–1.77	.593
Sexual orientation			
Heterosexual	Reference	–	–
Other	1.81	0.64–5.14	.266
Race			
White	Reference	–	–
Other	0.73	0.29–1.84	.501
Ethnicity			
Non-Hispanic	Reference	–	–
Hispanic	0.40	0.12–1.37	.143
Parental education			
< Bachelors	Reference	–	–
≥ Bachelors	0.34	0.16–0.76	.008
School Type			
Private	Reference	–	–
Public	1.06	0.49–2.27	.886
Technical college	0.28	0.09–0.90	.032
Rural/urban			
Rural	Reference	–	–
Urban	1.06	0.49–2.27	.886
Other diagnoses	–	–	–
Depression	0.35	0.15–0.81	.014
Anxiety	0.37	0.15–0.92	.033
Substance use, past 30 day			
Alcohol	2.53	0.79–8.09	.118
Marijuana	2.83	1.31–6.13	.008
Tobacco	2.59	1.20–5.59	.015
Nagelkerke R-square	.394		

national estimate of 6.1%.[4] Moreover, 45.7% reported use of PS in the past 4 months without a diagnosis of ADHD or prescription for PS; this is higher than rates documented in prior research.[31,32] Correlates of use of PS without an ADHD diagnosis or without a prescription for the stimulant included lower parental education, a proxy for SES. This finding may reflect issues related to health literacy and/or access to healthcare, as lower SES is related to these challenges. Those who did not have a prescription/diagnosis versus those who did also reported being older at the first time of use, which may be an additional indicator of such healthcare access/utilization issues that may lead to delays in obtaining PS. NMPS was also associated with not having a diagnosis of depression or anxiety. This provides further support for the notion that NMPS may be a matter of healthcare access or utilization, as having these other mental health diagnoses – which are commonly comorbid with ADHD – would indicate that these problems were detected and treated. It is also noteworthy that PS may be used to elevate mood, reduce suicidal ideations, treat depression that is resistant to traditional anti-depressant drug therapy, and treat symptoms of anxiety.[33]

Interestingly, both PS use and NMPS use were associated with attending a private school (relative to a technical school), which is consistent with the literature.[11,17] Prior research has also documented that higher SES is associated with higher rates of NMPS use.[15,34] For example, one study[34] found that individuals that came from families with a family income greater than $1,00,000 are more than two times more likely to illicitly use stimilants, compared to those with lower incomes. Collectively, these findings are difficult to interpret but may indicate that higher SES, parental education and perhaps knowledge of mental health risks, and overall access to healthcare may be critical factors related to PS use without a prescription or a diagnosis of ADHD.

Substance use also distinguished use of PS with versus without an ADHD diagnosis or prescription. More specifically, past 30-day tobacco and marijuana use was correlated with NMPS use. These findings align with literature stating that tobacco and marijuana use is higher not only among those diagnosed with ADHD but also among those who choose to self-medicate or use PS non-medically.[17,25,27,28,35] Those who did not have a prescription/diagnosis versus those who did were more likely to indicate they snort their medication, which may reflect similar underlying risk factors for other substance use.

In the current study, the most commonly reported reasons for taking stimulants included to enhance concentration and focus, to be more productive with school work, and to get work done more efficiently, all of which have previously been documented in the literature.[11,15,17,21] Compared to those who had a prescription, those who did not were more likely to use PS for reasons such as to have a more enjoyable time or to party longer, all of which are recreational motives.

Regarding side effects of PS, students commonly reported difficulty falling asleep, feeling fidgety, feeling anxious, heart palpitations, and not feeling hungry; these findings coincide with prior research.[14] Those who had a prescription versus those who did not differed with regard to such adverse effects as difficulty falling asleep, headaches, feeling fidgety, feeling anxious, and not feeling hungry. Compared to those who had a prescription, those who did not were less likely to report difficulty falling asleep, headaches, not feeling hungry, and feeling fidgety or anxious. These types of adverse symptoms may be a deterrent to NMPS.

The current findings have implications for research and practice. Our study highlights correlates of PS use among students attending different types of institutions, including those that have not been extensively studied such as those attending technical colleges. Additional research is needed to further understand PS use of individuals who are not diagnosed with ADHD but are still prescribed PS. In particular, there is a need to further understand and address the role of SES and healthcare access. For example, college campuses with student health centers should emphasize the importance of proper screening for ADHD and other mental health and learning disorders, as well as to facilitate access to proper treatments for students from all socioeconomic backgrounds. Campuses without student health centers, such as technical college campuses, need to develop referrals, coordination, and other resources to facilitate student healthcare access. Qualitative research should also examine the experiences of college students with PS use (e.g., reasons for use, access, sharing of stimulants), particularly among students who are not diagnosed with ADHD or prescribed stimulants. Moreover, a more sophisticated understanding of

multilevel factors that influence PS and NMPS use, particularly social influences, is needed; for example, advanced methods such as social network analyses could shed light on such influences. In practice, supportive measures should be put into place to ensure students in need of mental health services receive them and are appropriately diagnosed and treated. Campus-based services must educate students about the adverse affects of NMPS use and provide resources for students who may be struggling academically or who may not be able to handle their courseload.

Limitations

Limitations include limited generalizability given the sample was drawn from colleges/universities in Georgia, and the proportion of male (albeit large) was smaller relative to the proportion of women. However, it is important to note that the sample was drawn from diverse schools, including private, public, technical, and historically black colleges and universities in both rural and urban settings. Second, the parent study focused on tobacco use, rather than on PS use, thus limiting the assessment of the range of relevant factors (e.g., comprehensive assessment of access/sources, reasons for use). Third, the study didn't assess specific aspects of college life (e.g., Greek membership), which may have beeen helpful in characterizing students who used PS and NMPS. Finally, the data were self-reported and cross-sectional, raising concerns about bias reports and inability to make causal attributions among the variables assessed.

Conclusions

With the US using more PS than any other country, the use of PS without a prescription on college campuses is concerning. This study provides data on correlates of PS use without a prescription and characteristics of PS use among a diverse sample of post-secondary students across a southeastern state. Findings underscore the potentially important role of healthcare access in PS use among college students, as well as distinct motives for use among PS users with versus without a prescription or ADHD diagnosis. Future research should take into account access to PS on campuses, as well as evaluating resources on campus that will aid in reducing academic-related stress.

Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Boards of Emory University, ICF International, and the collaborating universities/colleges.

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