# It is illegal to post this copyrighted PDF on any website. Prevalence and Correlates of Prescription Stimulant Misuse Among US College Students: Results From a National Survey

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#### ABSTRACT

**Objective:** There is a high prevalence of prescription stimulant misuse (PSM) among college students in the United States (US). Preventing and identifying PSM requires an understanding of risk factors and correlates, but large-scale surveys regarding this issue have been lacking. We present the largest multi-institution study to date on the correlates of PSM among US college students.

**Methods:** We performed a secondary analysis of the 2017 American College Health Association–National College Health Assessment (ACHA-NCHA), an annual national survey on the demographics, health, and academic experiences of US college students. Logistic regression models examined associations between past-year PSM in 40,645 undergraduate college students and hypothesized risk factors.

**Results:** PSM was reported in 8% of college students. PSM was associated with past-year diagnosis or treatment of depression (adjusted odds ratio [AOR] = 1.16; 99% CI, 1.01–1.33), anorexia (AOR = 1.44; 99% CI, 1.02–2.03), attention-deficit/hyperactivity disorder (AOR = 1.66; 99% CI, 1.41–1.95), and substance use disorder/other addiction (AOR = 1.79; 99% CI, 1.30–2.46). The odds of PSM were 5.5 times higher for students who endorsed past-month use of "Legal drugs" and 8 times higher for students who endorsed past-month use of "Illegal drugs" than for those who did not. Other factors associated with PSM included academic difficulty, daytime sleepiness, fraternity or sorority involvement, White race, and cis-male gender.

**Conclusions:** This study identifies many potential risk factors for PSM among US undergraduate college students. Targeted outreach, prevention, and clinical management are discussed. As the COVID-19 pandemic has exacerbated psychiatric distress, sleep difficulties, substance use, and attentional challenges among college students, this study may serve as a baseline for future studies examining the impact of COVID-19 on PSM among college students.

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Stimulant medications prescribed for the treatment of attention-deficit/hyperactivity disorder (ADHD) are currently classified by the US Drug Enforcement Administration as Schedule II substances due to their high potential for misuse.<sup>1</sup> The chief motivation for prescription stimulant misuse (PSM) is to enhance concentration and academic performance,<sup>2-5</sup> though recreation and weight loss may be additional motives.<sup>3,5</sup> College students exhibit higher rates of PSM than same-aged peers not enrolled in college.<sup>6,7</sup>A meta-analysis of 14 studies of undergraduates<sup>2</sup> revealed a prevalence of past-year PSM ranging from 5% to 35%. College students perceive stimulant medication as easy to obtain, with the most common source being friends with prescriptions.<sup>2</sup> Association with drug-misusing peers has also been identified as a risk factor for adolescent PSM.<sup>8,9</sup> Other sources include obtaining medication online or from multiple doctors, known as "doctor shopping."<sup>10</sup> In a survey of college students with medication prescriptions,<sup>11</sup> stimulants were the most commonly diverted, and 62% of students reported having shared or sold their stimulant medication at least once. The health consequences of PSM can be life-threatening, as stimulants can precipitate psychosis, myocardial infarction, cardiomyopathy, and sudden death.<sup>12</sup>

A body of literature has examined key correlates of PSM among college students. Previously identified risk factors include untreated ADHD symptoms or ADHD diagnosis,<sup>13–19</sup> depressive symptoms,<sup>13,20,21</sup> eating disorders,<sup>22</sup> other substance use,<sup>13,14,23–28</sup> sleep disturbance,<sup>29,30</sup> poor academic performance,<sup>13–15,23</sup> higher college admissions selectivity,<sup>18</sup> year in school (risk increases with each year in college),<sup>2,17</sup> majoring in a STEM (science, technology, engineering, mathematics) field,<sup>31</sup> fraternity or sorority membership,<sup>2,14,19,32</sup> non–varsity-athlete status,<sup>17</sup> male gender,<sup>2,16,17,26,31–34</sup> White race,<sup>2,5,32,34,35</sup> higher socioeconomic status,<sup>26,32,33</sup> and a range of personality characteristics, including perfectionism, impulsivity, sensation seeking, and low self-esteem.<sup>23,29,36,37</sup>

While prior studies have examined the prevalence of and risk factors for PSM, a key limitation is the samples on which such conclusions are drawn. As explicitly noted in several prior reviews and meta-analyses,<sup>2,13,15,19</sup> existing studies on PSM rates and correlates have limited generalizability due to small samples and/or single-institution datasets. For example, of the 30 studies examined in a recent meta-analysis,<sup>2</sup> only 5 included samples of over 2,000 students, and 23 were conducted at a single university. Patterns of PSM may vary widely across different institutions, as evidenced by the wide range of PSM

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#### **Clinical Points**

- There has been growing research on prevalence and risk factors of prescription stimulant misuse (PSM) among college students, but none has examined this topic in a single large-scale, multi-institution sample.
- Misuse of prescription stimulants among college students can be prevented by raising awareness of the prevalence of misuse and of risk factors and signs of potential PSM.

rates reported in prior studies.<sup>3,24</sup> The literature currently lacks a single large-scale, multi-institution investigation of the many potential predictors of PSM among college students. Given the prevalence of PSM in this group and the associated public health risks, analysis of a large, multisite dataset is an important step in advancing understanding of the determinants of PSM among college students and better informing PSM prevention strategies.

In this article, we present the first such analysis of the prevalence and correlates of PSM among college students using the largest multi-institution dataset on college student health, the American College Health Association-National College Health Assessment (ACHA-NCHA). This annual national research survey collects data on a wide range of indicators of college student health. We utilized data from the Spring 2017 administration of the survey, which included 40,645 undergraduate students attending 89 colleges and universities throughout the US. Our goal was to establish a more robust and comprehensive pre-pandemic set of predictors of PSM among college students to help guide clinicians, educators, and policymakers who wish to address this issue and to serve as a baseline for comparison in the post-pandemic world.

#### **METHODS**

#### Data Source and Sample

Data were obtained from the Spring 2017 American College Health Association-National College Health Assessment (ACHA-NCHA IIB) Reference Group.<sup>38</sup> The full dataset consisted of 63,497 students attending 92 colleges and universities across the United States. Each institution administered the survey to a random sample of enrolled students 18 years of age or older. Institutions chose their own method of survey delivery; 89 institutions administered web-based surveys, with a 19% average response rate, and the remaining 3 institutions administered paper surveys, with an 81% average response rate. The protocol for this study was approved as an expedited application through the Institutional Review Board at Mass General Brigham and was deemed exempt from human subjects review.

The current study included degree-seeking undergraduate students with available data on the primary outcome of interest, PSM, and measures of all risk factors described herein. Consistent with other studies,<sup>39,40</sup> survey respondents were excluded if they reported implausible height and weight data. Only respondents who reported heights between 120 cm (3 feet, 9 inches) and 210 cm (6 feet, 9 inches) and

a body mass index between 16 to 65 kg/m<sup>2</sup>, were retained. The final analytic sample included 40,645 degree-seeking undergraduate students attending 89 US colleges and universities. Note that the final sample drawn from 89 institutions represents both institutions that administered online surveys and those that administered paper-based surveys. The 3 institutions not represented in the final sample were excluded due to a range of reasons such as having graduate students, non-degree-seeking students, and individuals who did not provide responses to questions used in the analysis.

#### Measures

Outcome. The outcome of interest was PSM in the past 12 months. This outcome was assessed by self-report to the question: "Within the last 12 months, have you taken any of the following prescription drugs that were not prescribed to you?" The question asked about a range of different prescription drugs, and the current study focused on student response to the item "stimulants (eg, Ritalin, Adderall)." Respondents could indicate either "Yes" or "No."

Predictors. The following measures were incorporated as predictors in the final statistical model. Their selection was based on prior literature suggesting associations with PSM.

Age was coded as a binary variable: "18-24 years" (traditional-aged undergraduate students) and "25+ years."41

Gender was coded as "Male," "Female," or "Another gender identity." This recoded gender variable was based on responses to 3 variables: sex at birth (female/male), transgender (yes/no), and gender identity (woman, man, trans woman, trans man, genderqueer, and another identity). Respondents were sorted into "Cis-male" or "Cis-female" if the respondent's sex assigned at birth aligned with their gender identity and if the respondent selected "No" for transgender. Respondents selecting "Yes" for transgender or whose sex at birth was not aligned with their gender identity were categorized as "Another gender identity."

Race/ethnicity was coded as "White," "Black," "Hispanic or Latino/a," "Asian or Pacific Islander," or "Biracial or Multiracial." Race/ethnicity was assessed by the question "How do you usually describe yourself? (Mark all that apply)." Participants who selected only one option were coded with the selected identity. Participants who selected more than one option were combined with those who selected "Biracial/Multiracial." Respondents who chose only "Other" or "American Indian, Alaskan Native, or Native Hawaiian" were excluded due to small sample sizes.

Sexual orientation was coded as "Heterosexual," "Gay/ lesbian," "Bisexual," "Asexual," and "Other" (the latter combining the options "Pansexual," "Queer," "Questioning," "Same gender loving," and "Another identity").

Five psychiatric disorders—ADHD, depression, anorexia, bulimia, and substance use disorder/other addiction (combined)-were assessed using respondents' self-report of having been diagnosed or treated by a professional for the specific mental disorder within the past 12 months.

## It is illegal to post this co Respondents could select P of 6 options ("No";

"Yes, diagnosed but not treated"; "Yes, treated with medication"; "Yes, treated with psychotherapy"; "Yes, treated with medication and psychotherapy"; or "Yes, other treatment"). These were recoded into a binary variable: "Yes" (combining the first 5 response options) or "No." "Substance use disorder" and "Other addiction" were combined into one variable ("Substance use/ addiction") such that the response would be coded as "Yes" if the respondent endorsed "Yes" for either variable and as "No" if the respondent endorsed "No" for both variables.

Past-month substance use was assessed. Respondents indicated how many days within the last 30 days they used a given substance, selecting from 8 options ("Never used"; "Have used, but not in last 30 days," "1-2 days," "3-5 days," "6-9 days," "10-19 days," or "20-29 days,"; or "Used daily"). These were recoded into a binary variable, with the first two options recoded into "No past month use" and the remaining 6 variables recoded into "Past month use." Three substances-"Cigarettes," "Alcohol (beer, wine, liquor)," and "Marijuana (pot, weed, hashish, hash oil)"-were combined into one variable ("Legal drugs"), as they are common recreational drugs that are legal in some states (note that the term *drugs* reflects the language used in the ACHA survey; however, we refer to these as substances throughout the article in keeping with efforts to destignatize terminology around substance use). "Legal drugs" was coded as "Yes" if the respondent endorsed past-month use of any of the 3 substances and as "No" if the respondent endorsed no past-month use of any of the 3 substances. Five substances—"Cocaine (crack, rock, freebase)," "Sedatives (downers, ludes)," "Hallucinogens (LSD, PCP)," "Opiates (heroin, smack)," and "MDMA (Ecstasy)"-were combined into one variable ("Illegal drugs"). "Illegal drugs" was coded as "Yes" if the respondent endorsed past-month use of any of the 5 substances and as "No" if the respondent endorsed no past-month use of any of the 5 substances.

Daytime sleepiness was assessed. Participants were asked, "In the past 7 days, how much of a problem have you had with sleepiness (feeling sleepy, struggling to stay awake) during your daytime activities?" Response options included "No problem at all," "A little problem," "More than a little problem," "A big problem," and "A very big problem." The first two response options were collapsed as "No problem," and the remainder were collapsed into "Problem."<sup>42</sup>

Academic stress was assessed. Participants were asked whether academics had been "Traumatic or very difficult for you to handle" within the last 12 months, with response options "Yes" or "No."

Factors related to academic status were included in the statistical model. We restricted our sample to degree-seeking students and included a variable for "Years in school" (first year, second year, third year,

Table 1 Pater of Procerintian Stimulant Misuse (DSM) Over th	
Table 1. Rates of Frescription Stimulant Misuse (FSM) Over th	ie –
Past 12 Months by Sociodemographic Factors	
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			PSM Over the Past 12 Months			
			No	)	Yes	
	Total (N =	40,645)	(n=37,375)		(n=3	,270)
Sociodemographic Factor	n	%	n	%	n	%
Race						
White Hispanic Black Asian Multiethnic	27,961 2,742 1,824 4,157 3,961	68.8 6.7 4.5 10.2 9.7	25,475 2,552 1,763 3,975 3,610	68.2 6.8 4.7 10.6 9.7	2,486 190 61 182 351	76.0 5.8 1.9 5.6 10.7
Gender						
Male Female Non-binary	12,009 27,637 999	29.5 68.0 2.5	10,877 25,578 920	29.1 68.4 2.5	1,132 2,059 79	34.6 63.0 2.4
Sexual Orientation						
Heterosexual Gay/lesbian Bisexual Asexual Other	32,554 1,289 2,671 2,033 2,098	80.1 3.2 6.6 5.0 5.2	30,042 1,170 2,372 1,883 1,908	80.4 3.1 6.3 5.0 5.1	2,512 119 299 150 190	76.8 3.6 9.1 4.6 5.8
Year in School						
1st-year undergraduate 2nd-year undergraduate 3rd-year undergraduate 4th-year undergraduate 5th-year or more undergraduate	11,619 9,635 9,823 8,038 1,530	28.6 23.7 24.2 19.8 3.8	10,907 8,876 8,950 7,258 1,384	29.2 23.7 23.9 19.4 3.7	712 759 873 780 146	21.8 23.2 26.7 23.9 4.5
Student Status						
Domestic student International student	38,582 2,063	94.9 5.1	35,411 1,964	94.7 5.3	3,171 99	97.0 3.0
Transfer in Past 12 Months						
No Yes	35,396 5,249	87.1 12.9	32,502 4,873	87.0 13.0	2,894 376	88.5 11.5

fourth year, fifth year or more). Binary variables for transfer and international student status were also included.

Extracurricular activities hypothesized to be associated with PSM were incorporated into the final model. Participants answered "Yes" or "No" to whether they had participated in organized college athletics at the varsity level and whether they were a member of a social fraternity or sorority.

## **Data Analysis**

Descriptive statistics were calculated to compare sociodemographic characteristics and other predictors between respondents who did and did not endorse PSM (see Table 1).

A multivariate logistic regression model was generated to investigate associations between PSM and all aforementioned predictors, controlling for the clustering of data within schools. Given the large number of predictors and the large sample size, the  $\alpha$  level was conservatively set at .01, and 99% confidence intervals (CIs) are reported. The variables were normally distributed, and predictors indicated acceptable levels of collinearity (variance inflation factor [VIF] < 2.5).

## RESULTS

Of the final analytic sample of 40,645 students, 3,270 (8%) reported engaging in PSM in the last 12 months. The results of

## Table 2. Odds of PSM in the Past 12 Months Among Students Who Endorsed Predictor Relative to Those Who Did Not, Spring 2017

	Students F	Students Reporting PSM		
Characteristic	OR	99% CI		
Past-year diagnoses/treatment				
ADHD	1.66**	1.41-1.95		
Depression	1.16*	1.01-1.33		
Anorexia	1.44*	1.02-2.03		
Bulimia	0.93	0.60-1.42		
Substance use/other addiction	1.79**	1.30-2.46		
Past-month substance use				
Legal drugs	5.52**	4.54-6.71		
Illegal drugs	8.00**	6.96-9.15		
Academic difficulty	1.41**	1.27-1.58		
Daytime sleepiness	1.18**	1.06-1.31		
Fraternity/sorority	1.72**	1.52-1.95		
Varsity sports	1.02	0.86-1.22		
Race				
White	1.0			
Hispanic or Latino/a	0.85	0.68-1.05		
Black	0.49**	0.34-0.70		
Asian or Pacific Islander	0.63**	0.51-0.78		
Biracial or multiracial	0.90	0.76-1.06		
Age, y				
18–24	1.0			
25+	0.65**	0.51-0.83		
Gender				
Cis-male	1.0			
Cis-female	0.72**	0.65-0.81		
Another gender identity	0.63*	0.44-0.90		
Sexual orientation				
Heterosexual	1.0			
Gay/lesbian	0.90	0.68–1.19		
Bisexual	1.17	0.97-1.41		
Asexual	1.12	0.88-1.43		
Other	1.00	0.78-1.26		
Year in school				
1st	1.0			
2nd	1.14	0.98–1.33		
3rd	1.21*	1.05–1.40		
4th	1.23**	1.06-1.43		
≥5th	1.35*	1.03-1.77		
Transfer student	0.93	0.79-1.10		
International student	0.69*	0.51-0.92		

\**P*<.01. \*\**P*<.001.

Abbreviations: ADHD = attention-deficit/hyperactivity disorder, OR = odds ratio, PSM = prescription stimulant misuse.

Table 3. Model Characteristics						
Model Summary	X <sup>2</sup>	P Value of χ <sup>2</sup>	Nagelkerke <i>R</i> <sup>2</sup>			
Demographic variables (age, race, gender, sexual orientation)	134.166	<.001	0.8%			
Past-month substance use (illegal and legal drugs)	3210.311	.000	17.7%			
Past year diagnoses/treatment (ADHD, depression, anorexia, bulimia, substance-related disorder/ addiction)	481.797	<.001	2.7%			
School-related factors (year in school, transfer student, international student)	130.908	<.001	0.8%			
Fraternity/sorority	361.605	<.001	2.1%			
Varsity sports	.043	.835	0%			
Academic difficulty	189.937	<.001	1.1%			
Daytime sleepiness	96.887	<.001	0.6%			
Full model	3740.082	.000	20.5%			
Abbreviation: ADHD = attention-deficit/hyperactivity disorder.						

#### **chted PDF on any websit** the adjusted multivariable logistic regression model presented in Table 2.

Several sociodemographic characteristics were associated with PSM. PSM was less common in non-traditional-aged students (aged 25+ years) compared to traditional-aged students (aged 18–24 years) (adjusted odds ratio [AOR] = 0.65; 99% CI, 0.51–0.83) and less common in cis-female students (AOR = 0.72; 99% CI, 0.65–0.81) and students with another gender identity (AOR = 0.63; 99% CI, 0.44–0.90) compared to cis-male students. PSM was less common in Black (AOR = 0.49; 99% CI, 0.34–0.70) and Asian (AOR = 0.63; 99% CI, 0.51–0.78) students compared to White students. There was no statistically significant difference in the odds of PSM between Hispanic or multiethnic and White students. Sexual orientations, including gay/lesbian, bisexual, and asexual, were not significantly associated with PSM compared to heterosexual.

Psychiatric predictors associated with elevated odds of PSM included past-year diagnosis or treatment of depression (AOR = 1.16; 99% CI, 1.01–1.33), anorexia (AOR = 1.44; 99% CI, 1.02–2.03), ADHD (AOR = 1.66; 99% CI, 1.41–1.95), and substance use disorder/other addiction (AOR = 1.79; 99% CI, 1.30–2.46). There was no statistically significant difference in the odds of PSM between students who reported past-year diagnosis or treatment of bulimia and those who did not.

The odds of PSM were 5.5 times higher for students who endorsed past-month use of "Legal drugs" (cigarettes, alcohol, marijuana) than for those who did not (AOR = 5.52; 99% CI, 4.54–6.71) and 8 times higher for students who endorsed past month use of "Illegal drugs" (cocaine, sedatives, hallucinogens, opiates, 3,4-methylenedioxymethamphetamine [MDMA]) than for those who did not (AOR = 8.00; 99% CI, 6.96–9.15).

Respondents who reported "Yes" to academics being "traumatic or very difficult to handle" within the last 12 months had higher odds of reporting PSM (AOR = 1.41; 99% CI, 1.27–1.58) than those who reported "No." Respondents who reported experiencing daytime sleepiness also had higher odds of reporting stimulant misuse (AOR = 1.18; 99% CI, 1.06–1.31) than those who did not.

The odds of PSM were higher for students in their third year (AOR = 1.21; 99% CI, 1.05–1.40), fourth year (AOR = 1.23; 99% CI, 1.06–1.43), and fifth year or higher (AOR = 1.35; 99% CI, 1.03–1.77) compared to students in their first year of college. There was no statistically significant difference in the odds of PSM between first- and second-year students. International students had significantly lower odds of PSM compared to domestic students (AOR = 0.69; 99% CI, 0.51–0.92). There was no statistically significant difference in the odds of PSM between transfer students and non-transfer students.

Some extracurricular activities were associated with PSM. Respondents who were involved with a fraternity or sorority had higher odds of PSM than respondents not involved in these groups (AOR = 1.72; 99% CI, 1.52–1.95). However, involvement in varsity sports was not significantly positively or negatively associated with PSM.

**It is illegal to post this copy** The model characteristics are presented in Table 3. The full model accounts for about 21% of the model, with pastmonth substance use accounting for the most difference (approximately 18%).

## DISCUSSION

To our knowledge, this study is the largest to date on the prevalence and correlates of PSM in undergraduate students. Overall, 8% of 40,645 students across 89 US colleges reported past-year PSM. Prevalence reports from the existing literature are highly variable, with rates ranging from 5% to 35%.<sup>2</sup> The present study suggests that past-year PSM among US college students may be on the lower end of this range. Consistent with prior research in smaller single-institution studies, we found that PSM was associated with academic difficulty,<sup>13–15,23</sup> ADHD diagnosis,<sup>13–19</sup> depression,<sup>13,20,21</sup> eating disorders,<sup>23</sup> substance use,<sup>7,28</sup> fraternity or sorority membership,<sup>2,14,19,32</sup> higher year in college,<sup>2,17</sup> cis-male gender,<sup>2,16,19,26,32–34</sup> sleep disturbances,<sup>29,30</sup> and White race,<sup>2,5,32,35</sup> but not with non-varsity athlete status.

Information on risk factors for PSM among college students may aid in the clinical detection and management of problematic stimulant use behaviors. Some substance use screening tools, such as the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST),<sup>43</sup> explicitly incorporate screening for PSM. In settings where such tools are not used, or where routine substance use screening is not performed, knowledge of the correlates of PSM may be crucial for identifying at-risk students. Given the most common motive for PSM is academic-related, universities should attempt to detect and engage students who are feeling overwhelmed by academics. It is important to note that this study captures subjective academic-related stress; students can experience high levels of stress despite performing well academically. Academic advisors may serve an important function in identifying at-risk students, who can then be provided additional supports regarding evidencebased study skills such as note-taking, goal-setting, time management, and healthy ways of managing stress. It may also be beneficial to provide information regarding the adverse effects of PSM, including emotional lability, anxiety, insomnia, irritability, and negative academic outcomes, to balance views that prescription stimulants can enhance academic performance.<sup>7,13,18</sup>

ADHD diagnosis was associated with PSM in the current study. However, this finding is based on correlational, crosssectional data. A meta-analysis of longitudinal studies<sup>44</sup> demonstrated that treating youth with ADHD with stimulant medication neither protects against nor increases the risk of later substance use disorders, countering the concern that stimulant medication sensitizes youth to future substance use. This finding suggests that parents and stakeholders should not be discouraged from providing a diagnosis of ADHD out of concern for future PSM, so long as the diagnosis is clinically indicated. An appropriate diagnosis of ADHD remains important, as it informs appropriate treatment, **including stimulant medication and nonpharmacologic** modalities such as cognitive-behavioral therapy and parentchild interaction therapy, which have been found to be efficacious.<sup>45,46</sup> Further research is needed to elucidate the mechanisms underlying the positive association between ADHD diagnosis and PSM in college students.

Elevated rates of PSM among students in fraternities and sororities points to the importance of targeted outreach to this population. Interventions should be implemented to students in Greek organizations to educate about the prevalence and effects of PSM as well as strategies to navigate and resist peer pressure. In addition, consequences could be institutionalized for Greek organizations themselves if their members are caught engaging in PSM, including administrative probation.

The finding that PSM was less common in Black and Asian students compared to White students, while consistent with prior literature, should be interpreted with caution. The current ACHA sample demonstrates limited racial diversity, consisting of 68.8% White students. Structural barriers limit access among non-White students to predominantly White institutions, and PSM among more representative samples of non-White young adults may not be well captured in the current sample. Additionally, access to prescription stimulants is associated with financial resources and access to health care,<sup>47</sup> which may generally be higher in White populations.<sup>48,49</sup>

The elevated rates of PSM among students who reported past-month use of both legal and illegal substances are in line with previous research.<sup>18</sup> While cannabis was considered a legal substance in our study, whether cannabis use was licit or illicit was uncertain. Nonetheless, the high risks of PSM among students who engage in substance use is an important finding, as young adults who engage in substance use and PSM may be susceptible to engaging in other risky behaviors.<sup>18</sup> Future research should better characterize the association between PSM and substance use to uncover any social and/or neurobiological underpinnings. The motivation for PSM among students who engage in substance use should also be explored. For example, if students engage in PSM to counteract the effects of other substances (eg, impaired concentration and sedation), treatment of the underlying substance misuse should be prioritized.

Clinicians who diagnose and treat ADHD should stay informed about the prevalence of PSM among college students. Because hallmark symptoms of ADHD (eg, restlessness, inattention) also characterize diverse psychiatric disorders, more thorough screenings and clinical assessments are necessary to clarify the appropriate diagnosis and treatment. Prescribing physicians should also increase monitoring efforts and limit access to medications to students, eg, by dispensing limited amounts of medication at a time, and should be aware of signs of addictive behavior and potential PSM, such as insistence on increasing dosages or frequent reports of lost prescriptions. Suspected PSM may benefit from the use of alternative treatments, including nonstimulant medications, stimulant medications with

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**It is illegal to post this copyr** lower abuse potential, and nonpharmacologic strategies such as cognitive-behavioral therapy, biofeedback, relaxation techniques, and psychotherapy.<sup>50</sup>

This study has several strengths. Its sample size makes it the largest existing investigation of PSM in college students to date. Its use of a multi-institution dataset mitigates the effects of institutionally and geographically specific substance use norms, which limit the generalizability of single-institution studies. Finally, prior validity and reliability studies have demonstrated that the ACHA-NCHA data are similar to data from nationally representative samples.<sup>51</sup>

The results of this study must also be interpreted in light of its limitations. The current study defines PSM as applying to students who use prescription stimulants not prescribed to them and therefore excludes students who may be considered to misuse prescription stimulants by taking these substances in higher doses and/or more often than prescribed. As per the recommendations of other scholars,<sup>2</sup> a broader, more inclusive definition of stimulant misuse may more accurately capture PSM patterns of college students who are prescription and nonprescription holders. Despite the similarity of the ACHA-NCHA data to nationally representative data, this survey did not employ probabilitybased sampling and may not be generalizable to all college students in the United States. This survey-based investigation may be vulnerable to recall and response bias. Furthermore, **causality** or the direction of some observed relationships. For example, it is not possible to discern whether academic difficulty and sleep disturbance predispose college students to engage in PSM, or whether PSM itself leads to academic difficulty and sleep disturbance. Finally, this study is not able to determine the mechanisms for the observed associations. Future research efforts could mitigate these limitations through standardized operationalization of stimulant misuse,<sup>2</sup> use of large probability-based datasets, longitudinal study designs, and qualitative methods that examine the psychological and sociocultural mechanisms underlying the associations.

Limitations notwithstanding, this study contributes robust evidence on risk factors for PSM in US college students. These findings can inform efforts by clinicians, educators, and policymakers to identify and prevent PSM in college populations. The COVID-19 pandemic has compounded psychological distress among college students. Elevated levels of depression, anxiety, and PTSD symptoms,<sup>52</sup> increased sleep disruption,<sup>53</sup> increased alcohol and cannabis use,<sup>54</sup> and greater attentional challenges due to remote learning<sup>55</sup> could all exacerbate PSM. Thus, this study may serve as an important baseline to compare with a follow-up study of more recent data to examine the effects of the pandemic on college students' stress and PSM.

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*Editor's Note:* We encourage authors to submit papers for consideration as a part of our Focus on Childhood and Adolescent Mental Health section. Please contact Karen D. Wagner, MD, PhD, at kwagner@psychiatrist.com.