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Attention-deficit/hyperactivity disorder–specific stimulant misuse, mood, anxiety, and stress in college-age women at high risk for or with eating disorders

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ABSTRACT

Objective: To examine the misuse of attention-deficit/hyperactivity disorder (ADHD)-specific stimulants in a college population at high risk for or with clinical or subclinical eating disorders. **Participants**: Four hundred forty-eight college-age women aged 18–25 at high risk for or with a clinical or subclinical eating disorder. **Methods**: Participants completed assessments of stimulant misuse and psychopathology from September 2009 to June 2010. **Results**: Greater eating disorder pathology, objective binge eating, purging, eating disorder–related clinical impairment, depressive symptoms, perceived stress, and trait anxiety were associated with an increased likelihood of stimulant misuse. Subjective binge eating, excessive exercise, and dietary restraint were not associated with stimulant misuse. **Conclusions**: ADHD-specific stimulant misuse is associated with eating disorder and comorbid pathology among individuals at high risk for or with clinical or subclinical eating disorders. Screening for stimulant misuse and eating disorder pathology may improve identification of college-age women who may be engaging in maladaptive behaviors and inform prevention efforts.

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The nonmedical use and misuse of attention-deficit/hyperactivity disorder (ADHD)-specific stimulants (eg, Ritalin, Adderall, Dexedrine) have become common high-risk behaviors on college campuses.[1–4] Up to 34% of college students report lifetime nonmedical use of ADHD-specific stimulants,[3,5,6] and up to 17% of college students report nonmedical use of ADHD-specific stimulants in the past year.[1,7] Methylphenidate, commonly known as Ritalin, is considered to have a high potential for abuse and psychological dependence by the US Drug Enforcement Administration.[8] Large doses of methylphenidate can lead to cardiac arrest, and continued misuse can lead to dependence.[2] Previous research has identified who is at most risk of abusing stimulants in a general college population, such as individuals who identify as white or who are in a fraternity,[1,5,7,9–11] but there is a need to extend this research by examining psychological variables in specific groups of college students who may be more likely to abuse stimulants, such as those at high risk for the development of (herein referred to as "at high risk for") or with a clinical or subclinical eating disorder.[12,13]

Reduced appetite is a common side effect of stimulant use,[14] and college students report misusing these stimulants for weight loss purposes.[2] Moreover, the US Food and Drug Administration recently approved an ADHD-specific stimulant, Vyvanse, for the treatment of binge eating disorder, with a noted possible side effect of weight loss.[15,16] Thus, it is particularly timely to understand whether or not individuals are misusing ADHD stimulants and for what reason misuse may occur. Additionally, patients with eating disorders who endorse bulimic symptomatology (eg, binge eating episodes, vomiting) have been found to be more likely to misuse substances compared with patients with eating disorders who endorse restrictive symptomatology.[12,13] Understanding whether those at high risk for or with a clinical or subclinical eating disorder who endorse bulimic symptomatology are more likely to misuse ADHD-specific stimulants than those without such symptoms is important, especially given that Vyvanse prescriptions may increase for patients with binge eating disorder.

Although stimulant misuse has been found to significantly correlate with body image issues and disordered

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eating in general college samples,[14,17] to our knowledge, ADHD-specific stimulant misuse has not yet been studied in relation to eating disorder–related psychopathology in a college sample at high risk for or with a clinical or subclinical eating disorder. Given the high rate of eating problems among college women and that the majority of college women with eating and body image concerns do not necessarily meet full DSM-5 (*Diagnostic and Statistical Manual of Mental Disorders, 5th Edition*) criteria,[18] examining a more inclusive sample of clinical, subclinical, and high-risk groups will better capture the association between stimulant use and eating disorder psychopathology in the college population. Additionally, despite significant correlations between stimulant misuse and depression, stress, and anxiety among college students,[19] the extent to which these relations hold in a sample at high risk for or with a clinical or subclinical eating disorder is unclear. Understanding the associations between ADHD-specific stimulant misuse and eating disorder psychopathology in this population at high risk for or with a clinical or subclinical eating disorder may inform targets for screening among college students, who may be engaging in maladaptive behaviors such as stimulant misuse, and identify novel targets for eating disorder preventive or treatment interventions.

Thus, the aim of the current study was to extend previous research by conducting the first examination of differences in eating disorder–related and comorbid psychopathology between those who did and did not report lifetime stimulant misuse in a sample of college-age women at high risk for or with a clinical or subclinical eating disorder. Our design also expands upon research that has examined this behavior in individual institutions, as our sample was recruited from 14 universities and the neighboring community over 2 geographic regions, increasing the potential generalizability of the findings. We hypothesized that, compared with those who do not report stimulant misuse, those who reported stimulant misuse would have significantly different body image concerns, eating disorder pathology, eating disorder–related clinical impairment, depressive symptoms, perceived stress, and trait anxiety.

Methods

Participants

Five hundred forty-nine women entered into the study either at low risk for an eating disorder ($n = 96$), at high risk for an eating disorder ($n = 346$), or with a DSM-5[20] clinical or subclinical eating disorder ($n = 107$) as part of a larger clinical trial. DSM-5 clinical and subclinical diagnoses were generated based on data from the Eating Disorder Examination.[21] Participants were considered at high risk for an eating disorder if they scored at least 47 on the Weight Concerns Scale (WCS).[22,23] Participants were between 18 and 25 years of age and had a body mass index between 18 and 32 kg/m^2. The vast majority of these women were enrolled in undergraduate- or graduate-level courses at universities and colleges in close proximity to the institutions conducting the study. Interested individuals were excluded from entering the study if they were male, were actively suicidal or psychotic, were suffering from bipolar disorder, did not have regular Internet access, or resided outside the metropolitan regions of the university sites. Women who reported current prescription medication for mood or anxiety disorders were included if their medication was stable for at least 2 weeks. For the purposes of the current study, we elected to only include participants at high risk for or with a DSM-5 clinical or subclinical eating disorder.*

Procedures

Participants were recruited via word-of-mouth, e-mail distribution via publicly available student group e-mail lists, flyers, social media, and the university research volunteer database between September 2009 and June 2010 from 14 colleges and universities in the San Francisco Bay and Saint Louis metropolitan areas. Recruitment advertisements were broadly targeted at women concerned about their weight or shape and/or wanting to improve feelings about one's body or mood and reduce stress. Interested individuals contacted the study staff and were screened via an online questionnaire that was sent to their e-mail. The online questionnaire was used to assess for inclusion criteria (ie, were female, lived within the metropolitan regions of the study site, and had regular Internet access) and to determine whether the individual qualified as high risk for an eating disorder (WCS score $\geq$47). Notably, there were no differences in WCS scores between the 2 institutions conducting the study ($t(446) = 0.293$, $p = .770$), suggesting that our primary screening inclusion criterion was not skewed towards one of these institutions. Individuals who met study entry criteria were invited to complete an in-person assessment. Trained study staff conducted assessments at the participating colleges and universities. Permission was obtained from each of the participating universities to conduct assessments on site. All participating institutions were in close proximity to the primary

* Differences in measures of eating disorder and comorbid pathology between participants at low risk for an eating disorder, high risk for an eating disorder, and with a clinical or subclinical eating disorder have been published previously.[29]

study sites. All study assessments were conducted in a private office to maintain confidentiality and privacy of the participant. This study was approved by the institutional review boards at all participating sites, and informed consent was obtained from all participants.

Measures

Demographics

Demographic characteristics were collected via self-report measures and included age in years, education level of the participant's most educated parent/guardian as a proxy measure for socioeconomic status, and racial/ethnic background. For the purpose of the current analyses, education level of the participant's most educated caregiver was coded as college graduate or not. Consistent with past literature,[7] we collapsed our racial/ethnic background categories into "White" and "non-White," given the higher rates of ADHD-specific stimulant use among white students.[3,5,6,24] Body mass index (BMI) was calculated from participants' objectively measured height and weight, which were assessed in person using a calibrated scale and portable stadiometer by trained study staff. Given that ADHD medications are often used for weight loss or to maintain a low weight,[2,14,17] BMI was included in the analyses for the current study to determine whether BMI differentiated individuals who endorsed versus denied ADHD-specific stimulant misuse.

Drug use item questionnaire

Participants were instructed to self-report their history of drug misuse by responding "Ever used (circle yes or no)" to a list of 50 drugs. These drugs, organized by drug class, included tobacco, sedatives/hypnotics/anxiolytics ("downers"), stimulants ("uppers"), opioids, cocaine, hallucinogens, and "other." Participants were instructed to endorse drug use history "ONLY if you have used them outside of a doctor's prescription." Thus, participants responded "No" if they had never used the drug or used the drug as prescribed. Participants also checked a box for each drug they endorsed if the following statement was characteristic of its use: "Use PRIMARILY as a means of controlling my weight/shape." Given the aim of the current study, responses regarding use of the following stimulants or "uppers" were included in the analyses: Dexedrine, Ritalin, and Adderall. These drugs were selected as they are approved for the treatment of ADHD, readily available to college students,[2] and commonly misused on college campuses as a weight loss aid.[2–7,24] This measure of drug use was created for the purposes of the study.

Eating disorder psychopathology

The WCS is a 5-item self-report questionnaire used to assess worry about weight and shape, fear of gaining 3 pounds, last time on a diet, importance of weight, and feelings of fatness. Participants rated their responses on a 5-point scale, with higher numbers indicating higher concerns about weight. Because the items have different response scales, the items are transformed to generate a total score of 100. The WCS has shown good reliability and predictive validity in a community sample of adolescent girls.[22] In the current study, alpha was .650, which was acceptable.[25]

The Eating Disorder Examination-Questionnaire (EDE-Q),[21] a self-report questionnaire of 36 items, was used to measure eating disorder psychopathology over the past 28 days. Responses are rated on a 7-point scale, ranging from 0 (Not at all) to 6 (Markedly). The EDE-Q yields 4 subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern) and a global score.[26] It has been shown to have acceptable concurrent validity and criterion validity in a community sample of women aged 18–45.[26] In the current study, alpha for the 4 subscales ranged from .704 to .858 and alpha for the global score was .856. A modified version of the Eating Disorder Examination (EDE) version 14.0,[27] a semistructured interview, was administered to participants. For the purposes of this study, only data on the presence versus absence of episodes of objective binge eating, subjective binge eating, purging (ie, vomiting, laxative misuse, and diuretic misuse), and excessive exercise over the previous 3 months were used. The purging behaviors were combined into 1 variable given that the limited number of individuals who endorsed each behavior precluded separate analyses. Responses were dichotomized due to the wide variability of behavior frequency, and this approach is consistent with past eating disorder research.[28,29] The EDE has been shown to have discriminant validity and internal consistency in patients with eating disorders.[30] The Clinical Impairment Assessment (CIA) version 3.0, a 16-item self-report questionnaire, was used to assess the extent to which eating behaviors or thoughts about weight and shape directly impact daily functioning over the past 28 days.[31,32] The CIA focuses on parts of life that are most likely to be negatively affected by eating disorder pathology, such as cognitive, emotional, interpersonal, and vocational functioning. Participants responded on a 4-point Likert scale (0 = Not at all; 3 = A lot) to questions such as, "Over the past 28 days, to what extent have your eating habits, exercising, or feelings about your eating, shape or weight interfered with your relationships with others?" The CIA has demonstrated construct validity, internal

consistency, and test-retest reliability in community samples of young women[28,33] and high internal consistency, good convergent validity, and discriminant validity in women at risk for an eating disorder.[28] In the current study, alpha was .941. Across all 4 measures, higher scores indicate higher levels of pathology.

Comorbid psychopathology

The Beck Depression Inventory II (BDI) is a 21-item, self-report questionnaire that assesses depressive symptomatology over the previous 2 weeks.[34] Participants endorse depressive symptoms on a 4-point Likert scale, in which higher scores indicate more severe symptoms such as guilt or hopelessness. It has shown internal consistency, reliability, and validity in college student populations.[35] In the current study, alpha was .921. The Perceived Stress Scale (PSS), a 14-item self-report measure of the degree to which one's life situations are appraised as stressful, has shown adequate reliability and validity in college students.[36] Participants respond to items such as "In the last month, how often have you felt nervous and stressed?" and "In the last month, how often have you dealt successfully with day to day problems and annoyance?" on a 5-point Likert scale from 0 (Never) to 4 (Very often), with select items reverse-coded. In the current study, alpha was .888. The 20-item trait anxiety subscale of the self-report Spielberger State-Trait Anxiety Inventory (STAI) measures anxiety as a long-standing personality trait and has been shown to have adequate construct validity and test-retest reliability in college students.[37] Items include "I worry too much over something that doesn't really matter," rated on a 4-point scale from 0 (Almost never) to 3 (Almost always). In the current study, alpha was .926. Across all 3 measures, higher scores indicate higher levels of pathology.

Analytic plan

SPSS version 23.0 (IBM, Armonk, NY) was used for statistical analyses. Data were screened for normality, and skew and kurtosis were satisfactory on all variables except BMI, which was log-transformed and excluded cases with outliers ($n = 5$) exceeding 3 times the standard deviation of the standardized mean. Independent-samples t tests and chi-square tests were used to examine differences in high-risk versus clinical or subclinical eating disorder categorization and demographic variables (ie, age, race, parental education, BMI, and study site) between those who endorsed versus denied a history of ADHD-specific stimulant misuse. Logistic regression analyses were used to evaluate the likelihood of ADHD-specific stimulant misuse based on severity of eating disorder psychopathology (ie, WCS, EDE-Q global and subscale scores, CIA, eating disorder behaviors) and comorbid psychopathology (ie, BDI, PSS, and STAI trait anxiety subscale), controlling for significant demographic variables. Odds ratios and their 95% confidence intervals are presented as measures of effect sizes. Tests of multicollinearity among continuous predictors were satisfactory.[38,39] All tests were 2-tailed, and p values $<.05$ were considered statistically significant.

Results

Forty-seven students (10.5%) endorsed having ever used ADHD-specific stimulants outside of a doctor's prescription. Of these 47 participants, 8 women (17.0%) endorsed using ADHD-specific stimulants primarily as a means of controlling their weight/shape. Participants with a clinical or subclinical eating disorder were significantly more likely to report ADHD-specific stimulant misuse (22 users out of 106 with a clinical or subclinical eating disorder = 20.8%) compared with participants at high risk for an eating disorder (25 users out of 342 at high risk for an eating disorder = 7.3%) ($\chi^2(1) = 15.58$, $p < .001$). Differences in demographic variables between those who endorsed versus denied ADHD-specific stimulant misuse are presented in Table 1, with significant differences emerging between those who endorsed versus denied ADHD-specific stimulant misuse in terms of race and BMI ($ps < .004$).

In order to provide an even more stringent test of the study hypotheses, logistic regression analyses were run controlling for race and BMI. The pattern of results comparing ADHD-specific stimulant misuse between individuals at high risk for versus with a clinical or subclinical eating disorder remained the same controlling for race and BMI (Exp(B) = 0.313; 95% confidence interval [CI] = 0.165–0.594; $p < .001$).

Eating disorder pathology

Results on differences in eating disorder pathology between individuals who endorsed versus denied ADHD-specific stimulant misuse users are presented in Table 2. Eating disorder pathology was significantly associated with ADHD-specific stimulant misuse, such that scores on measures of eating disorder global pathology, eating concerns, weight concerns, shape concerns, body image concerns, eating disorder–related clinical impairment, binge eating, and purging were significantly associated with an increased likelihood of ADHD-specific stimulant misuse, controlling for race and BMI ($ps < .041$). However, dietary restraint, subjective binge eating, and excessive exercise were not significantly

Table 1. Sample characteristics by stimulant user status.

	Full sample($N = 448$)		Users($n = 47$)		Nonusers($n = 401$)			
Characteristic	Mean	SD	Mean	SD	Mean	SD	Statistic	*p* value
Age	20.66	1.97	20.83	1.92	20.65	1.98	$t(446) = -0.63$	.53
Body mass index	24.68	4.32	23.30	3.19	24.84	4.40	$t(69) = 2.99$	.004
	n	%	*n*	%	*n*	%		
White (vs non-White)	249	55.6%	38	80.9%	211	52.6%	$\chi^2(1) = 13.58$	<.001
Parents graduated college	316	70.5%	32	68.1%	284	71.0%	$\chi^2(1) = 0.17$	.74
Study site							$\chi^2(1) = 0.003$	>.99
San Francisco Bay area	240	53.6%	25	53.2%	215	53.6%		
St. Louis	208	46.4%	22	46.8%	186	46.4%		

associated with ADHD-specific stimulant misuse, controlling for race and BMI (*p*s > .153).

Comorbid pathology

Results on differences in comorbid pathology between individuals who endorsed versus denied ADHD-stimulant misuse are presented in Table 2. Greater depressive symptoms, perceived stress, and trait anxiety were significantly associated with an increased likelihood of ADHD-specific stimulant misuse, controlling for race and BMI (*p*s < .001).

Comment

The current study aimed to extend previous examinations of ADHD-specific stimulant misuse in college-age samples by investigating ADHD-specific stimulant misuse and its association with eating disorder and comorbid psychopathology in college-age women at high risk for or with a clinical or subclinical eating disorder. In our sample, approximately 10% of women endorsed having ever used an ADHD-specific stimulant outside of a doctor's prescription. Consistent with hypotheses, endorsement of ADHD-specific stimulant misuse was associated with greater severity of global eating disorder pathology, eating, shape, and weight concerns, body image concerns, binge eating and purging, eating disorder–related clinical impairment, depression, stress, and anxiety. Our sample included women who were at high risk for an eating disorder as well as individuals with subclinical eating disorders, which is important given that the majority of college women with eating disturbances do not meet criteria for full-syndrome clinical eating

Table 2. Eating disorder and comorbid pathology variables by stimulant user status.

	Users		Nonusers							
Pathology	Mean	**SD**	Mean	SD	OR	95% CI	*p* value	AOR	95% CI	*p* value
Eating disorder pathology										
WCS	66.14	15.28	58.64	17.34	1.03	1.01–1.05	.005**	1.03	1.01–1.05	.001**
EDE-Q Global	2.85	0.97	2.34	1.03	1.59	1.19–2.13	.002**	1.67	1.24–2.25	.001**
EDE-Q Restraint	2.54	1.31	2.18	1.23	1.25	0.98–1.59	.068	1.20	0.94–1.53	.153
EDE-Q Eating Concern	1.66	1.14	1.27	1.10	1.33	1.04–1.70	.024*	1.38	1.07–1.78	.014*
EDE-Q Shape Concern	3.75	1.13	3.18	1.30	1.44	1.12–1.85	.004**	1.61	1.23–2.09	<.001**
EDE-Q Weight Concern	3.43	1.17	2.74	1.31	1.53	1.19–1.96	.001**	1.70	1.32–2.20	<.001**
CIA	17.33	9.82	11.89	9.50	1.05	1.02–1.08	<.001**	1.06	1.03–1.09	<.001**
	n	%	*n*	%						
Objective binge episodes	17	36.2%	99	24.7%	1.73	0.92–3.27	.092	1.99	1.03–3.85	.041*
Subjective binge episodes	22	46.8%	173	43.1%	1.16	0.63–2.13	.632	1.36	0.73–2.53	.338
Purging	13	27.7%	46	11.5%	2.95	1.45–6.00	.003**	2.52	1.21–5.23	.013*
Excessive exercise	13	27.7%	81	20.2%	1.51	0.76–2.99	.237	1.29	0.63–2.64	.485
	Mean	**SD**	Mean	SD						
Comorbid pathology										
BDI-II	16.17	11.39	10.03	8.56	1.06	1.03–1.10	<.001**	1.08	1.05–1.12	<.001**
PSS	21.26	6.85	17.85	6.64	1.08	1.03–1.13	.001**	1.09	1.04–1.14	<.001**
STAI Trait Anxiety	49.30	11.45	42.06	11.29	1.06	1.03–1.08	<.001**	1.06	1.03–1.10	<.001**

Note. OR = odds ratio; AOR = adjusted odds ratio, controlling for race and body mass index; WCS = Weight Concerns Scale; EDE-Q = Eating Disorder Examination-Questionnaire; CIA = Clinical Impairment Assessment; purging = vomiting, laxative misuse, and diuretic misuse; BDI-II = Beck Depression Inventory-II; PSS = Perceived Stress Scale; STAI = Spielberger State-Trait Anxiety Inventory.
*$p < .05$;**$p < .01$.

disorders.[18] Results also revealed a significant difference in ADHD-specific stimulant misuse between women at high risk for and with a clinical or subclinical eating disorder, suggesting that ADHD-specific stimulant misuse may be more likely with increasing levels of eating disorder pathology. Taken together, results suggest that signifying targeted screening and intervention efforts for ADHD-specific stimulant misuse and eating disorder pathology may be warranted.

The prevalence of ADHD-specific stimulant misuse in our sample is consistent with previous research on ADHD-specific stimulant misuse in college populations that shows an average prevalence of 9.6% in this group.[7,10,19,40] Our finding of heightened pathology in participants who misuse stimulants is also consistent with past research demonstrating a relationship between stimulant misuse and increased psychopathology and distress.[14,19] The finding that increased stimulant misuse was associated with body image issues and disordered eating, specifically, is consistent with previous research studying these constructs in general college samples.[14,17] Our findings support that this relationship is also present within the specific group of college-age women at risk for or with a clinical or subclinical eating disorder. Even within a sample identified for having higher levels of psychological distress (ie, our population at high risk for or with a clinical or subclinical eating disorder, rather than a general college population), it was shown that the odds of stimulant use were greater as eating disorder symptomatology increased. Given that substance use disorders—including stimulant misuse—and eating disorders are commonly comorbid,[12,13] and because many college students consider ADHD-specific stimulants "definitely not drugs,"[41] it is important to assess, and if appropriate, educate students, especially those at high risk for or with a clinical or subclinical eating disorder, on the dangers of misusing ADHD-specific stimulants.

Dietary restraint was not associated with stimulant misuse in our sample. This finding is consistent with extant literature showing that individuals with the restricting subtype of anorexia nervosa were less likely to endorse stimulant misuse or substance abuse than individuals with other eating disorder diagnoses (ie, anorexia nervosa binge purge subtype or bulimia nervosa).[12,13] Although DSM-5 does not use the subtype classification system for eating disorder diagnoses and therefore our data preclude us from examining stimulant misuse by eating disorder subtype, it is possible that individuals with higher levels of dietary restraint are not drawn to misusing stimulants as a means of controlling their weight and shape. Previous research supports that individuals with high dietary restraint may be less impulsive or novelty-seeking than individuals with other eating disorder symptom profiles,[12,42] making high-risk behaviors such as stimulant misuse potentially less likely. It is also possible that individuals with high levels of dietary restraint may not feel the need to misuse stimulants for the side effect of appetite suppression, given that these individuals are already engaged in restrictive dieting strategies. Further research, including prospective longitudinal studies, is necessary, as our finding that dietary restraint was not more likely among participants who misused stimulants suggests that not all individuals at heightened risk for or with a clinical or subclinical eating disorder are equally likely to abuse stimulants.

Our results showed that participants who endorsed ADHD-specific stimulant misuse were more likely than nonusers to endorse objective binge eating and purging, consistent with previous studies that have shown an association between bulimic symptomatology and substance misuse.[12,13] Individuals who endorsed ADHD-stimulant misuse also had a 2.52 times greater likelihood of endorsing purging behaviors than individuals who denied stimulant misuse, controlling for race and BMI. Taken together, these results suggest that individuals who misuse stimulants are also engaged in harmful, clinically relevant eating disorder behaviors, highlighting the need for intervention to address these behaviors.

Despite that college students report misusing ADHD-specific stimulants for weight loss purposes,[2,14] only approximately one fifth of women in our sample who endorsed misusing ADHD-specific stimulants endorsed misusing them primarily for weight/shape reasons. However, even though this low proportion endorsed misusing stimulants for weight/shape reasons, results showed that women who misused ADHD-specific stimulants had higher concerns about their shape and weight than their nonuser counterparts. This suggests that women may not be accurately reporting their reasons for misusing ADHD-specific stimulants, they may view appetite suppression as a desirable side effect but not the primary reason for use, or they may not recognize any relationship between their weight/shape concerns and their ADHD-specific stimulant misuse. Although our data are limited in that we cannot know participants' primary reason for misusing ADHD-specific stimulants (as our measure only inquired about whether participants' primary motivation was as a means of controlling weight/shape), stimulant misuse across the sample may have been at least partially motivated by issues related to weight or shape, given the heightened eating disorder pathology and eating disorder–related clinical impairment in the subgroup who endorsed stimulant misuse.

Participants may also have been motivated to misuse stimulants to deal with undiagnosed attentional and executive function disturbances or undiagnosed ADHD. Patients with eating disorders have been shown to have difficulties with executive functioning,[43,44] such as difficulties with decision-making,[45] set-shifting,[43] and attention,[46] which could be particularly debilitating in an academically challenging environment such as college. As such, women at high risk for or with a clinical or subclinical eating disorder may begin experiencing these deficits in college and may turn to ADHD-specific stimulants to address these symptoms. Individuals who may be misusing stimulants to address attentional difficulties may benefit from further assessment and possible referral for prescription drug use as appropriate. It will also be important for health care professionals to be aware of the ADHD-specific stimulant Vyvanse that was recently approved for the treatment of binge eating disorder.[16] Results of a randomized controlled trial showed that patients randomized to receive this medication had significantly improved binge eating pathology, specifically a decrease in binge eating, compared with individuals in a placebo condition.[15] Thus, certain ADHD-specific stimulants may be beneficial for a subset of patients with eating disorders, suggesting that appropriate and healthful use of these medications for eating pathology and/or attentional problems may be indicated. Importantly, participants in our study were not asked about their use of Vyvanse, and current data were collected prior to Vyvanse being indicated for binge eating. However, monitoring stimulant misuse in those at high risk for or with a clinical or subclinical eating disorder is increasingly important in future research and clinical care.

Finally, it is possible that participants may have endorsed misusing ADHD-specific stimulants even if they have a doctor's prescription for stimulant use. This would suggest that participants might be engaged in self-medicating activities, which could result in problematic consequences. Given the heightened mental health pathology among stimulant misusers in our sample, opportunities to understand motivations for misuse and curtail unhealthy consequences may be important to pursue. Accordingly, future research to understand the various motivations for stimulant misuse among women at high risk for or with a clinical or subclinical eating disorder may inform intervention targets for reducing this behavior.

Implications

The prevalence of ADHD-specific stimulant misuse on college campuses has implications for health education and intervention efforts. ADHD-specific stimulant use, even with a prescription, is associated with dangerous side effects, such as vomiting, psychosis, insomnia, depression, cardiac arrest, and dependence. Nonprescription stimulant misuse among college students has also been associated with high-risk behaviors such as drug use and risky driving, sexual activity, and spending.[2,47] Given the association between ADHD-specific stimulant misuse and heightened eating disorder pathology in this sample, screening for the presence of these comorbid conditions is important as a means to detect individuals particularly vulnerable to high-risk behaviors and increased pathology. Screening both at the university population level and among individuals presenting to student health or counseling centers may be beneficial for increasing the likelihood of identifying individuals engaged in these concerning behaviors. Further, the study findings highlight the need for practitioners to screen for stimulant misuse among college students when they identify eating-related problems, even if they do not present as fully symptomatic or if they do not meet full-syndrome clinical criteria for an eating disorder. The finding that eating disorder–related clinical impairment was higher among individuals who endorsed versus denied ADHD-stimulant misuse also speaks to the need for increased screening to identify and address these concerns among college students.

Psychoeducation about the danger of this behavior could also be incorporated into college health promotion efforts. As ADHD-specific stimulant misuse is considered socially acceptable on college campuses[5,41] and misusers of ADHD-specific stimulants have limited knowledge of the risks and consequences of their behavior,[5] increased education may be particularly beneficial for decreasing this behavior. Individuals who endorse stimulant misuse as a means of controlling their shape or weight may benefit from learning strategies to establish healthy weight management practices.

Limitations

Limitations of this study should be noted. First, one limitation is the use of self-report measures of pathology, which may be subject to problems associated with retrospective recall. A second limitation is that the Drug Use Item Questionnaire was developed for this study and has not been validated. As noted earlier, it is possible that participants were misusing stimulants even if they had a doctor's prescription for their use or that they were misusing stimulants for weight/shape reasons even if this was not participants' primary reason for use. This limitation highlights the need for validated measures of stimulant use[1] with response options that yield more precise assessment of college students' reasons for stimulant

misuse. Second, the use of a cross-sectional design is a study limitation, as it precludes drawing conclusions about the impact of ADHD-stimulant use on risk for eating disorder onset. However, understanding the stimulant abuse histories of individuals in this particular population is an important step in identifying risk factors for stimulant abuse and eating disorders. Future studies are warranted to evaluate these symptoms longitudinally to assess for risk factors. Third, our sample could be biased by the fact that it consists of students presenting to participate in psychological research on eating and body image concerns, which may not be representative of the female college-age population generally. An important next step may be to study a full population of university students to assess the prevalence and levels of impairment among individuals endorsing ADHD-specific stimulant misuse and eating disorder pathology. Finally, although our study draws participants from universities and the community surrounding the 2 institutions conducting the study, our sample may still be limited in generalizability beyond the scope of the 2 geographic regions from which participants were drawn.

Conclusions

In conclusion, our findings demonstrated that ADHD-specific stimulant misuse is associated with heightened eating disorder and comorbid pathology among college-age women at risk for or with a clinical or subclinical eating disorder. Future prospective research is needed in order to ascertain whether ADHD-specific stimulant misuse is a risk factor for eating disorder onset. Moreover, examining the temporal relationship between age of eating disorder onset and stimulant misuse may provide important insights into the relationship between these conditions. Given that ADHD-specific stimulant misuse is prevalent on college campuses and may be harmful to women with disordered eating symptoms given its side effect of appetite suppression, as well as that these stimulants may be prescribed to patients with binge eating disorder, integrating assessment of ADHD-specific stimulant use and misuse into screens for eating disorders in college-age women may improve identification of individuals who may be engaging in maladaptive behaviors and inform prevention efforts.

Conflict of interest disclosure

Dr Wilfley is a consultant for Shire Pharmaceuticals on binge eating disorder. All other authors declare no financial relationships or conflicts of interest with any organizations that may have an interest in the submitted work. 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 Stanford University and Washington University in St. Louis.

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