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BRIEF REPORT

Stimulant Medication Use in College Students: Comparison of Appropriate Users, Misusers, and Nonusers

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While stimulant medication is commonly prescribed to treat Attention-Deficit/Hyperactivity Disorder in children and adolescents (Merikangas, He, Rapoport, Vitiello, & Olfson, 2013; Zuvekas & Vitiello, 2012) and is considered an empirically supported intervention for those groups (Barkley, Murphy, & Fischer, 2008; Pelham & Fabiano, 2008; Safren et al., 2005) surprisingly little is known about the efficacy of stimulants in the slightly older emerging adult population. A focus has emerged, however, on illicit stimulant use among undergraduates, with studies suggesting such behavior is not uncommon (e.g., Arria et al., 2013). Unfortunately, details are lacking regarding outcomes and personal characteristics associated with different patterns of stimulant misuse. The current study compares the characteristics of four groups of college students, including those with stimulant prescriptions who use them appropriately (i.e., appropriate users), those who misuse their prescription stimulants (i.e., medical misusers), those who obtain and use stimulants without a prescription (i.e., nonmedical misusers), and those who do not use stimulant medications at all (i.e., nonusers). Undergraduates (N = 1,153) from the Southeastern, Midwest, and Rocky Mountain regions completed online measures evaluating patterns of use, associated motives, side effects, ADHD symptomatology, and other substance use. Both types of misusers (i.e., students who abused their prescriptions and those who obtained stimulants illegally) reported concerning patterns of other and combined substance use, as well as higher prevalence of debilitating side effects such as insomnia and restlessness. Research and practical implications are discussed.

Keywords: ADHD, psychostimulant misuse, college students, emerging adults

Studies estimate a 4–14% yearly incidence of nonprescribed stimulant medication use in college students (American College Health Association [ACHA], 2010; Hall, Irwin, Bowman, Frankenberger, & Jewett, 2005; McCabe, Teter & Boyd, 2006; Wey-

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andt et al., 2009; White, Becker-Blease, & Grace-Bishop, 2006), which is higher than the national prevalence of cocaine, hallucinogen, or inhalant use (SAMHSA, 2011), and approximately double the prevalence of prescribed stimulant use (2–3%; Babcock & Byrne, 2000; Stone & Merlo, 2011) in this age group. In considering stimulant abuse, however, it is important to note that not all who use illicitly are qualitatively similar. While motive (e.g., getting high vs. increasing concentration) is one way to categorize stimulant users (Teter, McCabe, Cranford, Boyd & Guthrie, 2005), means and degree of use differentiate among (a) *medical misusers* (i.e., those with a prescription who periodically use excessive doses), (b) *nonmedical misusers* (i.e., those who obtain and use stimulants illegally), and (c) *appropriate users* (i.e., those who use prescription according to instructions). The need for closer examination of these groups is underscored by the somewhat ambiguous stimulant-related maladjustment (Bogle & Smith, 2009), and infrequent and incomplete differentiation among misuser groups in the literature.

Although prevalence estimates vary widely (e.g., 4%, McCabe, Knight, Teter, & Wechsler, 2005; 38%, Arria et al., 2013; 43%, Advokat, Guidry, & Martino, 2008), it seems likely that a substantial number of college students misuse stimulants (DeSantis, Webb, & Noar, 2008). In contrast to prescribed use of stimulants in college students with Attention-Deficit/Hyperactivity Disorder (ADHD; DuPaul, Weyandt, O'Dell, & Varejao, 2009), which some have suggested ameliorates maladjustment (Staufer & Greydanus, 2005), nonmedical misuse is correlated with lower grades (McCabe et al., 2005), academic concerns (Rabiner et al., 2009), risk for polysubstance abuse (Rozenbroek & Rothstein, 2011), and a desire to improve studying (Stone & Merlo, 2011). However, unaddressed symptoms of ADHD may be linked to nonmedical misuse of stimulants too, with one study finding that 12% of nonmedical misusers believed they had the disorder (Advokat et al., 2008). It is also possible that students without ADHD use stimulants to enhance academic performance (Smith & Farah, 2011), as staying awake and increasing studying efficiency are frequent rationales for misuse (Advokat et al., 2008).

While addressing undiagnosed or undertreated ADHD and related academic problems is a motive for misuse that parallels the intended purpose of prescription stimulants, recreation (i.e., euphoric effects; Teter et al., 2005) and socialization (White et al., 2006) are not uncommonly endorsed as reasons for use. This may be particularly prevalent in nonmedical misusers, as approximately one fifth of this group reports using stimulants while drinking (Low & Gendaszek, 2002), and to prolong intoxication (Rabiner et al., 2009). Some have suggested that stimulant use may be even more reinforcing in social situations, as the resulting alertness may facilitate prolonged social engagement (Hall et al., 2005). However, recreational motives for stimulant abuse do not outrank academic motives among nonmedical misusers, and are uncommonly the sole motive reported (Rabiner et al., 2009).

Specific personality characteristics have also been related to stimulant misuse, with both sensation seeking (Arria, Caldeira, Vincent, O'Grady & Wish, 2008) and perfectionism (Low & Gendaszek, 2002) positively predicting this behavior in college populations. Further, men appear more likely than women to misuse stimulants (Bogle & Smith, 2009; Hall et al., 2005; see exception in McCabe et al., 2005), which may be due to sex differences in risk-taking (Byrnes, Miller & Schafer, 1999) or knowledge about from whom one can illicitly obtain stimulants (Hall et al., 2005).

Immediate adverse consequences of stimulant use have been reported in college student nonmedical misuser samples, including appetite reduction (63%), sleep problems (60%), irritability (45%), and reduced academic self-efficacy (41%; Rabiner et al., 2009). Taken with the potential legal consequences of illicit use of a Schedule II substance (e.g., methylphenidate) and increased risk of polysubstance abuse, this suggests illicit stimulant use is associated with risk across several domains. However, particularly given some studies suggesting relatively mild and circumscribed maladjustment in misusing college students (e.g., Bogle & Smith, 2009), replication and further detailing of the putative adverse consequences associated with illicit stimulant use is a valid aim, especially given the potential downside of overly negative portrayals (e.g., Food and Drug Administration caps on production).

This study examined four college student groups differentiated by type of stimulant use (i.e., nonusers, nonmedical and medical misusers, appropriate users). Given the extant literature, hypotheses were as follows: (a) both misuser groups were expected to more frequently nominate recreational motives for stimulant use; (b) misusers, given their nonprescribed drug use, were expected to endorse high rates of other illicit substance use (i.e., concurrent to stimulant use or at other times in the past year); (c) nonmedical misusers would report more ADHD-related symptomatology (i.e., inattention, hyperactivity) than nonusers, but less than either appropriate users or medical misusers; (d) nonmedical misusers would be distinguished by high sensation seeking and perfectionism. Finally, other planned analyses examined whether groups differed on other motives for use, side effects, and methods of ingestion; however, given a relative dearth of direction from prior research for these variables, specific hypotheses were not made.

Method

Participants

Participants were 1,153 undergraduates (65.2% female; 88.4% European American) from four public universities located in the Southeast ($n = 2$), Rocky Mountain ($n = 1$), and Midwest ($n = 1$) regions of the United States who were compensated with class credit. The mean age of these participants was 19.72 years ($SD = 1.45$; range: 18–25). Distribution by class standing was 46.2% freshmen, 24.0% sophomores, 16.8% juniors, and 13.0% seniors. Based on self-reported stimulant use, groups included (a) *nonusers* ($n = 708$), (b) *nonmedical misusers* (i.e., illicitly obtaining and using stimulant medication without a prescription; $n = 274$), (c) *appropriate users* (i.e., taking stimulants according to prescription; $n = 146$), and (d) *medical misusers* (i.e., using higher doses or more frequently than prescribed; $n = 25$). Agreement regarding group assignment was 100% (consensus of first, second, and fourth authors). At two of four universities, stimulant users were overselected via a prescreening questionnaire. Thus, the distributions across user status do not reflect the true prevalence of use and misuse on these college campuses.

Measures and Procedure

Participants completed all rating scales online in a fixed order after providing informed consent. Study procedures were approved by each university's Institutional Review Board.

Substance use. Participants reported whether they used a variety of legal and illegal substances in the past year (e.g., alcohol, cigarettes, marijuana). They also reported whether they used substances concurrently with prescription stimulants. Previous studies support the reliability and validity of self-reported substance use (Tucker, Murphy, & Kertesz, 2010), and endorsement of 12-month substance use or nonuse is also consistent with prior research in this area (e.g., Johnston, O'Malley, Bachman, & Schulenberg, 2013; Mohler-Kuo, Lee, & Wechsler, 2003; SAMHSA, 2011).

Stimulant use. Students were asked about: (a) use (e.g., "I have a prescription and take accordingly"; "I do not have a prescription but obtain stimulants and use them"; see White et al., 2006), (b) source for obtaining (e.g., received from my doctor/pharmacy, given by a friend/family member, or bought or stolen from someone; based on McCabe, Teter, & Boyd, 2006), (c) method of ingestion (e.g., oral, intranasal, or intravenous; as per Teter et al., 2005), (d) reasons for use (e.g., control ADHD symptoms, suppress appetite, or stay awake; adapted from Low & Gendaszek, 2002), and (e) side effects experienced while taking stimulants (e.g., insomnia, loss of appetite, or weight loss).

ADHD symptoms. ADHD symptoms were measured with an 18-item self-report measure of *DSM–IV* inattention and hyperactivity (Barkley & Murphy, 2006). Participants indicated whether they *never/rarely* (0), *sometimes* (1), *often* (2), or *very often* (3) experienced each symptom. Summary scores were created for inattention and hyperactivity. Internal consistency has been good for inattention ($\alpha = .80$) and adequate for hyperactivity ($\alpha = .73$) based on college student self-reports (e.g., Fedele, Hartung, Canu, & Wilkowski, 2010). In addition, interrater reliability has been found to be moderately high in adults (e.g., $r = .67$; Barkley, Knouse, & Murphy, 2011). Convergent and discriminant validity have also been demonstrated for adult self-reports (e.g., Magnusson et al., 2006). Internal consistency in the current sample was good for inattention ($\alpha = .87$) and adequate for hyperactivity ($\alpha = .76$).

Personality characteristics. Sensation seeking was measured using a 16-item version (Donohew et al., 2000) of the Sensation Seeking Scale (Zuckerman, 1994). Responses were *disagree a lot* (0), *disagree a little* (1), *don't agree or disagree* (2), *agree a little* (3), or *agree a lot* (4) and were aggregated into a summary score (range = 0 to 64). Previous reports of internal consistency were adequate ($\alpha = .79$; Donohew et al., 2000) and internal consistency was good in the current sample ($\alpha = .82$). Perfectionism was measured using a 24-item version (Khawaja & Armstrong, 2005) of the Frost Multi-Dimensional Perfectionism Scale (Frost, Marten, Lahart, & Rosenblate, 1990). This version has been reported to have excellent internal consistency ($\alpha = .90$) and strong concurrent validity with other measures of perfectionism (Khawaja & Armstrong, 2005). Responses range from *strongly disagree* (0) to *strongly agree* (4). There are four subscales: concern over mistakes (10 items), organization (4 items), parental expectations (6 items), and high personal standards (4 items). Internal consistency was adequate for parental expectations ($\alpha = .79$), good for organization ($\alpha = .88$) and concern over mistakes ($\alpha = .87$), but inadequate for high personal standards ($\alpha = .64$). Accordingly, the latter was omitted from analyses.

Results

Multinomial logistic regression analyses were conducted to examine relations between predictors and user status. For some analyses, all four user status groups were included. For other analyses, nonusers were not included because the items were not relevant (e.g., reasons for use, side effects). For all analyses, sex and university were entered as covariates due to significant differences across user status. In keeping with prior findings (e.g., Bogle & Smith, 2009), men were more likely to engage in nonmedical misuse than women ($p = .009$). Alpha corrections were conducted for all analyses and resulting p values are noted in each of the tables. For each regression, likelihood (i.e., χ^2) and pairwise odds ratios representing the unique relation between predictor and outcome variable (i.e., user status) are reported.

First, a logistic regression analysis was conducted to examine the relation between reasons for stimulant use and user status (see Table 1). We were particularly interested in using "to get high" as a measure of recreational use. However, we were not able to include this reason in the regression due to low levels of endorsement. Specifically, 13% of nonmedical misusers and 24% of medical misusers indicated using stimulants to get high (compared to none of appropriate users). With regard to other reasons for use, we conducted planned exploratory analyses. Results showed that both types of misusers endorsed some reasons significantly more often than appropriate users. Specifically, nonmedical and medical misusers were more likely to endorse using to stay awake than appropriate users. Also, nonmedical misusers were more likely to report using to study than appropriate users whereas medical misusers were more likely to endorse using to increase academic performance than appropriate users. Finally, both appropriate users and medical misusers were more likely to use "to control ADHD symptoms" than nonmedical misusers.

Another logistic regression analysis was conducted to examine the relation between use of other substances and user status (see Table 2). Across eight substances, nonusers of stimulants were the least likely to endorse use of other substances, appropriate users were next in terms of likelihood to endorse, and misusers were the most likely to endorse. Although alcohol use was surveyed, it could not be entered in the regression because 100% of medical misusers endorsed it.

Next, a logistic regression analysis was conducted to examine the relation between concurrent use of stimulants with other substances and user status (see Table 3). Appropriate users were typically the least likely to endorse concurrent use of additional substances. Medical misusers were significantly more likely to endorse concurrent marijuana use than appropriate users. Nonmedical misusers were more likely to endorse concurrent marijuana and pain medication use than appropriate users. Interestingly, nonmedical misusers were significantly less likely to endorse concurrent alcohol use than appropriate users.

Next, regressions were conducted to examine how user status related to ADHD and personality variables (see Table 4). Nonusers reported significantly lower levels of inattention and hyperactivity than any other group. In addition, nonmedical misusers reported lower levels of inattention than appropriate users and lower levels

Table 1
Multinomial Logistic Regression Analysis for Reasons for Stimulant Use by User Status

	Comparisons												
	Nonmedical misusers vs. appropriate users				**Medical misusers** vs. appropriate users				**Nonmedical misusers** vs. medical misusers				Omnibus
	NMM%	AU%	OR	*SE*	MM%	AU%	OR	*SE*	NMM%	MM%	OR	*SE*	$\chi^2(2, 443)$
Stay awake	49.6	18.5	3.77***	0.33	60.0	18.5	5.01**	0.53	49.6	60.0	0.75	0.53	*21.51*
Study	81.0	63.7	3.24**	0.36	84.0	63.7	0.93	0.71	81.0	84.0	3.48	0.73	*11.94*
Academics	54.0	61.0	0.73	0.35	96.0	61.0	13.93*	1.11	54.0	96.0	0.05**	1.10	*12.26*
Alertness	39.8	44.5	0.70	0.34	64.0	44.5	0.56	0.55	39.8	64.0	1.26	0.55	1.64
Control ADHD	11.3	69.2	0.06***	0.30	68.0	69.2	0.71	0.52	11.3	68.0	0.08***	0.50	*129.78*
Weight control	13.5	6.8	1.69	0.51	28.0	6.8	2.54	0.64	13.5	28.0	0.67	0.60	2.30
(Get "high")	13.1	0.0	—	—	24.0	0.0	—	—	13.1	24.0	—	—	—

Note. NMM = Nonmedical misusers (n = 274); MM = Medical misusers (n = 25); AU = Appropriate users (n = 146). OR = Odds ratio, calculated with the group in **BOLD** in the subheader (e.g., for NMM vs. AU, NMM) as the **criterion** and the other as the reference. *SE* = Standard error of the effect. Sex and university/site were entered as covariates at the first step of this logistic regression analysis. *Get* "high" was not included in logistic regression analyses due to nil endorsement by appropriate users, a violation of logistic regression assumptions. Alpha for each omnibus χ^2 test was set at .008 to compensate for family-wise error (6 predictors used in regressions; .05/6 = .008; χ^2 values in *italics* are $p < .008$).
* $p < .05$. ** $p < .01$. *** $p < .001$ (for pairwise OR).

of hyperactivity than medical misusers. With regard to personality, nonmedical misusers reported higher parental expectations than nonusers and appropriate users. Moreover, nonmedical misusers reported higher levels of sensation seeking than appropriate users and nonusers.

Exploratory analyses were conducted to examine differences across user groups for side effects, stimulant source, and ingestion. An analysis was conducted to examine the relation between side effects and user status (see Table 5). Overall, misusers appeared to experience more side effects; both misuser groups were significantly more likely to endorse exaggerated well-being and restlessness than appropriate users. In addition, nonmedical misusers were more likely to report insomnia and exaggerated well-being—and less likely to report weight loss, anxiety, or gastrointestinal problems—than appropriate users. Finally, medical misusers were more likely to endorse changes in sex drive than nonmedical misusers.

Finally, sources for obtaining stimulants and ingestion methods were examined. No regression analysis could be conducted for these variables because appropriate users obtained their stimulants exclusively from prescriptions and participants reported oral ingestion as their primary method. Notably, among nonmedical misusers, 81% got stimulants from a friend, 45% bought them, and 4% stole them. Additionally, nasal ingestion among nonmedical (17.9%) and medical misusers (20.0%) was much higher than for appropriate users (0.0%) although the difference between the two misuser groups was not significant.

Discussion

The purpose of this study was to compare characteristics of undergraduates who use, misuse, and do not use prescription stimulants. Overall, those classified as misusers (i.e., medical and nonmedical) presented relatively more concerning correlates than those who used stimulants according to prescription. First, although not statistically analyzed due to nonendorsement by all appropriate users, both medical and nonmedical misusers more frequently equate stimulant ingestion with recreation (i.e., getting high). Further, misusers appeared to experience different side effects. Notably, both misuser groups were more likely to endorse exaggerated well-being and restlessness than appropriate users. Nonmedical misusers were more likely to endorse insomnia than appropriate users, but less likely to have experienced anxiety, weight loss, or digestive problems. Unfortunately, "desirable" side effects (e.g., exaggerated well-being) may encourage misuse by off-setting negative consequences and reinforcing the expectation of euphoria.

Perhaps not surprisingly, misusers reported the highest rates of other substance use. Nonmedical misusers were more likely to report use of marijuana and hallucinogens than nonusers and appropriate users. Medical misusers were the most likely endorsers for all substances but these differences only reached statistical significance when compared to nonusers for cigarettes, amphetamines, and anxiety medication. When examining substances frequently used by college students (e.g., alcohol and marijuana; ACHA, 2010), appropriate users were more likely than nonusers to endorse use of these substances. This finding is consistent with prior research suggesting that ADHD is associated with increased risk for substance use (Wilens, 2004), but seems to contradict a documented protective effect of stimulant treatment (Biederman, 2003; Faraone & Wilens, 2003; Wilens, Faraone, Biederman, & Bunawardene, 2003). However, the current data cannot inform the prospective influence of stimulant intervention in childhood. Overall, it seems reasonable to conclude that stimulant misuse is associated with risk for broader substance use.

With regard to concurrent substance use, misusers were more likely than appropriate users to report marijuana use in combination with stimulants. In addition, nonmedical misusers were significantly more likely to endorse concurrent pain medication use than appropriate users. Such recreational use suggests that the motives of misusers may not be benign (e.g., extra dose for finals). This is consistent with other studies in which students frequently endorsed using stimulants while "partying" (e.g., Teter et al., 2005; White et al., 2006), and those in which short-term positive gain is

Table 2
Multinomial Logistic Regression Analyses for Use of Other Substances

	Comparisons												
	Nonmedical misusers vs. medical misusers				**Nonmedical misusers** vs. appropriate users				**Nonmedical misusers** vs. nonusers				Omnibus
	NMM%	MM%	OR	*SE*	NMM%	AU%	OR	*SE*	NMM%	NU%	OR	*SE*	$\chi^2(3, 1050)$
Cigarettes	62.1	76.0	0.32	0.62	62.1	44.8	0.91	0.27	62.1	24.7	1.30	0.21	7.32
Cigars/chew	40.4	37.5	1.20	0.57	40.4	27.1	1.74	0.30	40.4	18.2	1.84*	0.25	6.68
Marijuana	72.2	70.8	1.69	0.57	72.2	45.5	2.90**	0.26	72.2	24.3	4.40***	0.21	*54.26*
Amphetamines	18.6	20.0	0.72	0.71	18.6	4.2	2.30	0.54	18.6	0.6	4.77*	0.60	10.26
Hallucinogens	26.3	12.0	3.11	0.78	26.3	6.9	2.84*	0.45	26.3	1.9	4.36***	0.40	*17.69*
Ecstasy	17.8	16.0	0.96	0.68	17.8	4.9	1.63	0.48	17.8	1.0	2.53	0.49	4.30
Anxiety meds	34.5	44.0	0.71	0.53	34.5	24.7	0.78	0.29	34.5	6.1	2.70***	0.27	*23.36*
Pain meds	34.3	40.0	0.90	0.52	34.3	20.8	1.33	0.30	34.3	12.8	1.25	0.25	1.39
(Alcohol)	97.8	100.0	—	—	97.8	90.4	—	—	97.8	77.4	—	—	—

	Comparisons											
	Medical misusers vs. appropriate users				**Medical misusers** vs. nonusers				**Appropriate users** vs. Nonusers			
	MM%	AU%	OR	*SE*	MM%	NU%	OR	*SE*	AU%	NU%	OR	*SE*
Cigarettes	76.0	44.8	2.84	0.63	76.0	24.7	4.02*	0.61	44.8	24.7	1.42	0.24
Cigars/chew	37.5	27.1	1.45	0.60	37.5	18.2	1.53	0.58	27.1	18.2	1.06	0.28
Marijuana	70.8	45.5	1.24	0.58	70.8	24.3	2.61	0.56	45.5	24.3	2.10**	0.23
Amphetamines	20.0	4.2	3.20	0.83	20.0	0.6	6.64*	0.88	4.2	0.6	2.08	0.74
Hallucinogens	12.0	6.9	0.91	0.87	12.0	1.9	1.40	0.85	6.9	1.9	1.54	0.53
Ecstasy	16.0	4.9	1.70	0.77	16.0	1.0	2.63	0.80	4.9	1.0	1.55	0.60
Anxiety meds	44.0	24.7	1.10	0.56	44.0	6.1	3.83*	0.55	24.7	6.1	3.48***	0.29
Pain meds	40.0	20.8	1.48	0.56	40.0	12.8	1.38	0.54	20.8	12.8	0.93	0.29
(Alcohol)	100.0	90.4	—	—	100.0	77.4	—	—	90.4	77.4	—	—

Note. NMM = Nonmedical misusers (n = 274); MM = Medical misusers (n = 25); AU = Appropriate users (n = 146); NU = Nonusers (n = 708). OR = Odds ratio, calculated with group in **BOLD** in the subheader (e.g., for NMM vs. AU, NMM) as the **criterion** and the other as the reference. *SE* = Standard error of the effect. Sex and university were entered as covariates at the first step. Alcohol was not included in regression because 100% of medical misusers endorsed using. Alpha was set at .006 to compensate for family-wise error (8 predictors; .05/8 = .006; χ^2 values in *italics* are $p < .006$). Some substances were not included in the analyses because of lack of endorsement by any participant.
* $p < .05$. ** $p < .01$. *** $p < .001$ (for pairwise OR).

reported with stimulant misuse (Rabiner et al., 2009) despite low endorsement of long-term academic gain (Hall et al., 2005).

With regard to concurrent alcohol use, the three user groups reported relatively high rates, which is troubling due to potential interactions between alcohol and stimulants. Specifically, using stimulants in combination with alcohol may diminish the experience of alcohol-related effects. This may in turn lead to underestimation of inebriation (Flack et al., 2007; Hingson, Edwards, Heeren & Rosenbloom, 2009; Knight et al., 2002) and poor decisions (e.g., drunk driving, unsafe sexual activity) that could lead to

Table 3
Multinomial Logistic Regression Analyses for Concurrent Use of Other Substances and Stimulants

	Comparisons												
	Nonmedical misusers vs. appropriate users				**Medical misusers** vs. appropriate users				**Nonmedical misusers** vs. medical misusers				Omnibus
	NMM%	AU%	OR	*SE*	MM%	AU%	OR	*SE*	NMM%	MM%	OR	*SE*	$\chi^2(2, 443)$
Alcohol	43.1	52.1	0.41**	0.26	80.0	52.1	1.28	0.65	43.1	80.0	0.32	0.64	*.001*
Tobacco	27.7	26.7	0.99	0.28	60.0	26.7	2.01	0.54	27.7	60.0	0.49	0.52	.348
Marijuana	28.8	17.8	2.71**	0.31	56.0	17.8	3.40*	0.55	28.8	56.0	0.80	0.52	*.002*
Pain meds	12.0	4.8	3.81*	0.52	24.0	4.8	3.13	0.81	12.0	24.0	1.22	0.71	.023
Anxiety meds	10.2	8.2	0.60	0.46	24.0	8.2	0.85	0.76	8.2	24.0	0.70	0.72	.512

Note. NMM = Nonmedical misusers (n = 274); MM = Medical misusers (n = 25); AU = Appropriate users (n = 146). OR = Odds ratio, calculated with group in **BOLD** in the subheader (e.g., for NMM vs. AU, NMM) as the **criterion** and the other as the reference. *SE* = Standard error of the effect. Sex and university/site were entered as covariates at the first step of this logistic regression analysis. *Get* "high" was not included in logistic regression analyses due to nil endorsement by appropriate users, a violation of logistic regression assumptions. Alpha for each omnibus χ^2 test was set at .01 to compensate for family-wise error (5 predictors used in regressions; .05/5 = .01; χ^2 values in *italics* are $p < .01$).
* $p < .05$. ** $p < .01$. *** $p < .001$ (for pairwise OR).

Table 4
Multinomial Logistic Regression Analyses for (A) Inattention & Hyperactivity and (B) Perfectionism & Sensation Seeking by User Status

	Comparisons												Omnibus
	Nonmedical misusers vs. medical misusers				**Nonmedical misusers** vs. appropriate users				**Nonmedical misusers** vs. nonusers				
	NMM *M*(SD)	MM *M*(SD)	OR	*SE*	NMM *M*(SD)	AU *M*(SD)	OR	*SE*	NMM *M*(SD)	NU *M*(SD)	OR	*SE*	$\chi^2(3, 1050)$
Inattention	6.82 (4.87)	11.04 (5.94)	0.92	0.05	6.82 (4.87)	10.07 (5.90)	0.90***	0.03	6.82 (4.87)	4.53 (3.74)	1.09***	0.02	*68.37*
Hyperactivity	7.05 (4.16)	10.70 (4.53)	0.89*	0.06	7.05 (4.16)	8.74 (4.63)	0.99	0.03	7.05 (4.16)	5.38 (3.53)	1.05*	0.02	*12.04*
Perfectionism													
Parental expectations	12.06 (5.00)	12.56 (6.48)	1.03	0.05	12.06 (5.00)	10.87 (4.63)	1.10***	0.02	12.06 (5.00)	10.78 (5.38)	1.04*	0.02	*17.90*
Concern over mistakes	16.15 (7.72)	19.56 (9.55)	0.94*	0.03	16.15 (7.72)	18.54 (8.19)	0.94***	0.02	16.15 (7.72)	15.39 (8.57)	0.99	0.01	*27.23*
Organization	11.11 (3.82)	10.68 (5.02)	1.05	0.05	11.11 (3.82)	11.04 (3.87)	1.02	0.03	11.11 (3.82)	12.00 (3.53)	0.96*	0.02	*11.01*
Sensation seeking	42.81 (9.69)	41.56 (9.01)	1.01	0.02	42.81 (9.69)	39.15 (10.91)	1.04**	0.01	42.81 (9.69)	36.44 (10.50)	1.07***	0.01	*66.19*
	Comparisons												
	Medical misusers vs. appropriate users				**Medical misusers** vs. nonusers				**Appropriate users** vs. nonusers				
	MM *M*(SD)	AU *M*(SD)	OR	*SE*	MM*M*(SD)	NU *M*(SD)	OR	*SE*	AU *M*(SD)	NU *M*(SD)	OR	*SE*	
Inattention	11.04 (5.94)	10.07 (5.90)	0.97	0.05	11.04 (5.94)	4.53 (3.74)	1.18***	0.05	10.07 (5.90)	4.53 (3.74)	1.22***	0.03	
Hyperactivity	10.70 (4.53)	8.74 (4.63)	1.11	0.06	10.70 (4.53)	5.38 (3.53)	1.18**	0.06	8.74 (4.63)	5.38 (3.53)	1.06*	0.03	
Perfectionism													
Parental expectations	12.56 (6.48)	10.87 (4.63)	1.07	0.05	12.56 (6.48)	10.78 (5.38)	1.01	0.05	10.87 (4.63)	10.78 (5.38)	0.95*	0.02	
Concern over mistakes	19.56 (9.55)	18.54 (8.19)	0.99	0.03	19.56 (9.55)	15.39 (8.57)	1.05	0.03	18.54 (8.19)	15.39 (8.57)	1.06***	0.01	
Organization	10.68 (5.02)	11.04 (3.87)	0.98	0.06	10.68 (5.02)	12.00 (3.53)	0.91	0.05	11.04 (3.87)	12.00 (3.53)	0.93**	0.03	
Sensation seeking	41.56 (9.01)	39.15 (10.91)	1.02	0.02	41.56 (9.01)	36.44 (10.50)	1.05*	0.02	39.15 (10.91)	36.44 (10.50)	1.03**	0.01	

Note. NMM = Nonmedical misusers (n = 274); MM = Medical misusers (n = 25); AU = Appropriate users (n = 146); NU = Nonusers (n = 708). OR = Odds ratio, calculated with group in **BOLD** in the subheader (e.g., for NMM vs. AU, NMM) as the **criterion** and the other as the reference. *SE* = Standard error of the effect. Sex and university/site were entered as covariates at the first step of these two logistic regression analyses. Values without a common superscript are statistically significantly different ($p < .05$). One logistic regression analysis was conducted for Inattention/Hyperactivity; a second logistic regression was conducted for Perfectionism/Sensation Seeking. Alpha was set at .025 to compensate for family-wise error (2 predictors; .05/2 = .025; χ^2 values in *italics* are $p < .025$) for the Inattention/Hyperactivity analysis. For the Perfectionism/Sensation Seeking analysis alpha was set at .013 (4 predictors; .05/4 = χ^2 values in *italics* are $p < .013$). Range of scores for Inattention is 0 to 27, Hyperactivity is 0 to 27, Parental expectations is 0 to 24, Concern over mistakes is 0 to 40, Organization is 0 to 16, and Sensation Seeking range is 0 to 64.
* $p < .05$. ** $p < .01$. *** $p < .001$ (for pairwise OR).

Table 5
Logistic Regression Analysis for Various Side Effects of Stimulant Medication by User Status

	Comparisons												
	Nonmedical misusers vs. appropriate users				**Medical misusers** vs. appropriate users				**Nonmedical misusers** vs. medical misusers				Omnibus
	NMM%	AU%	OR	*SE*	MM%	AU%	OR	*SE*	NMM%	MM%	OR	*SE*	$\chi^2(2, 443)$
Change in sex drive	14.6	19.2	0.63	0.32	44.0	19.2	1.95	0.53	14.6	44.0	0.32*	0.50	5.81
Gastrointestinal	6.2	12.3	0.40*	0.44	32.0	12.3	1.26	0.67	6.2	32.0	0.32	0.65	5.94
Depressed mood	13.5	19.9	0.88	0.34	40.0	19.9	1.59	0.64	13.5	40.0	0.55	0.61	0.97
Anxiety	25.5	33.6	0.52*	0.29	40.0	33.6	0.34	0.63	25.5	40.0	1.53	0.61	6.60
Well-being	28.5	13.0	3.35***	0.32	52.0	13.0	4.99**	0.55	28.5	52.0	0.67	0.50	*18.67*
Dizziness	10.9	10.3	0.77	0.38	20.0	10.3	0.84	0.73	10.9	20.0	0.92	0.69	0.47
Headache	20.1	21.2	0.85	0.31	32.0	21.2	0.83	0.62	20.1	32.0	1.03	0.60	0.30
High blood pressure	8.8	4.8	1.81	0.52	24.0	4.8	1.45	0.78	8.8	24.0	1.25	0.69	1.34
Rapid heartbeat	42.3	34.2	1.19	0.26	64.0	34.2	1.37	0.55	42.3	64.0	0.86	0.54	0.60
Insomnia	49.3	36.3	1.68*	0.25	60.0	36.3	1.29	0.55	49.3	60.0	1.30	0.53	4.35
Loss of appetite	63.1	67.8	1.02	0.26	88.0	67.8	1.91	0.72	63.1	88.0	0.53	0.70	0.90
Weight loss	21.5	37.0	0.38***	0.28	56.0	37.0	0.93	0.53	21.5	56.0	0.41	0.51	*14.03*
Tremor/tics	9.5	6.8	1.32	0.45	24.0	6.8	1.64	0.72	9.5	24.0	0.81	0.66	0.62
Dry mouth	38.0	33.6	1.15	0.26	68.0	33.6	2.03	0.53	38.0	68.0	0.57	0.52	1.80
Restlessness	52.9	31.5	2.92***	0.26	64.0	31.5	3.00*	0.55	52.9	64.0	0.97	0.53	*19.31*

Note. NMM = Nonmedical misusers (n = 274); MM = Medical misusers (n = 25); AU = Appropriate users (n = 146). OR = Odds ratio, calculated with group in **BOLD** in the subheader (e.g., for NMM vs. AU, NMM) as the **criterion** and the other as the reference. *SE* = Standard error of the effect. Sex and university/site were entered as covariates at the first step of this logistic regression analysis. Get "high" was not included in logistic regression analyses due to nil endorsement by appropriate users, a violation of logistic regression assumptions. Alpha for each omnibus χ^2 test was set at .003 to compensate for family-wise error (15 predictors used in regressions; .05/15 = .003; χ^2 values in *italics* are $p < .003$).
* $p < .05$. ** $p < .01$. *** $p < .001$ (for pairwise OR).

physical harm (e.g., motor vehicle accident, sexually transmitted disease, unplanned pregnancy).

Regarding inattention, nonmedical misusers reported significantly lower levels than appropriate users but higher levels than nonusers. For hyperactivity, nonmedical misusers reported significantly lower levels than medical misusers, but higher levels than nonusers. Thus, nonmedical misusers may be using stimulants to address subthreshold ADHD, and self-medication may be a viable explanation for the behavior of some nonmedical misusers (Rabiner et al., 2009). Misusers endorsed levels of sensation seeking that were significantly higher than nonusers and appropriate users. This is consistent with research linking sensation seeking to substance abuse (Carlson, Johnson & Jacobs, 2010; Dunlop & Romer, 2010; Zuckerman, 1994). Group differences on perfectionism subscales were also evident. Most notable, perhaps, was that nonmedical misusers endorsed higher perceived parental pressure relative to nonusers. Thus, perception of parental expectations for academic success may moderate the misuse of stimulants among those without a prescription. When asked about sources for obtaining stimulants, 81% of nonmedical misusers reported getting them from friends, closely resembling previous findings (77.8%; Barrett, Darredeau, Bordey, & Pihl, 2005). This suggests that some—and potentially many—college students with prescription stimulants are taking their medication in smaller doses or less often than prescribed as there seem to be "leftovers" available to sell or share.

Limitations

First, the medical misuser group was small (n = 25), and this limited power to detect differences between this and other groups. Given that this group reported very high rates of problematic consequences that were often not statistically significantly different from other groups, more research with individuals who misuse stimulant prescriptions is warranted. Next, our assessments of substance use and ADHD symptoms were limited to self-report measures, and future research might use corroborating sources (e.g., biochemical and parent-report measures, respectively). Another limitation was related to reports of type and dose of stimulants. We attempted to gather this information but participant responses reflected confusion or lack of knowledge. Further, data regarding frequency of misuse, duration of use, and amount typically consumed are lacking. Future research should address such details to extend our appreciation for differences among user groups. Another limitation was related to the overselection of stimulant users, which increased power but decreased representativeness. Further, although the current data were derived from four universities, the findings may not fully generalize to groups underrepresented in this sample (see McCabe, Teter, & Boyd, 2004). Finally, while geographic region and Greek affiliation have been shown to potentially add to risk for illicit stimulant use in college (McCabe et al., 2005), we did not consider the impact of these variables in the current study; researchers should include these in the design of future studies.

Conclusions

These findings reinforce that the misuse of stimulants is associated with other risks, such as that for polysubstance misuse. However, stimulant misuse by itself, even for academic reasons, may have concerning side effects (Graham et al., 2011). One university's decision to change its honor code to include stimulant misuse as an "improper assistance" violation indirectly supports the call to proactively address this issue (Arria & DuPont, 2010; Diller, 2010; Wilens et al., 2008). Additionally, roughly 14% of

students in this sample misused a prescription. Further, 81% of nonmedical misusers obtained stimulants from a friend. These two findings emphasize the importance of prescribers closely monitoring consumption and openly discussing consequences of misuse and diversion with college students. For example, if a student reports only taking medication on weekdays, then 30 pills might last 6 weeks rather than 4. Therefore, prescribers may want to evaluate how often students are taking their medication and prescribe accordingly to reduce the quantity of stimulants available to be diverted.

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