The Misuse and Diversion of Prescribed ADHD Medications by College Students

By: David L Rabiner, Arthur D. Anastopoulos, E. Jane Costello, Rick H. Hoyle, Sean Esteban McCabe, H. Scott Swartzwelder

Rabiner, D.L., Anastopoulos, A.D., Costello, E.J., Hoyle, R.H., McCabe, S.E., & Swartzwelder, H.S. (2009), The misuse and diversion of prescribed ADHD medications by college students. Journal of Attention Disorders, 13(2), 144-153.

Made available courtesy of Sage Publications: http://dx.doi.org/10.1177/1087054708320414

Abstract:

Objective: This study assesses the misuse and diversion of prescribed attention deficit/hyperactivity disorder (ADHD) medications. Method: One hundred fifteen students, attending two universities, with prescriptions for ADHD medications completed a Web survey in spring 2007. Results: Eighty-nine of 115 students (69%) used their ADHD medications as prescribed, whereas 36 (31%) had misused during college by taking larger or more frequent doses than prescribed or by using someone else's medication. Nine students (8%) reported intranasal use during the previous 6 months, and 30 (26%) had diverted medications to peers. Misuse was associated with impulsivity and with other substance use. Enhancing the ability to study outside of class was students' primary motive for misuse, but nonacademic reasons were also reported. Students who misused ADHD medications generally felt that doing so was helpful. Conclusions: Although most students use their ADHD medication as prescribed, misuse and diversion is not uncommon. Because enhancing academic performance was the primary motive for misuse, the results raise questions about whether undergraduates with ADHD perceive their treatment as adequate and the extent to which physicians and students communicate about issues related to medication adjustments. (J. of Att. Dis. 2009; 13(2) 144-153)

Keywords: attention-deficit/hyperactivity disorder (ADHD) | college students | diversion | motives | prescription stimulants | prescription drug abuse

Article:

The use of attention-deficit/hyperactivity disorder (ADHD) medications by college students without a prescription, (i.e., nonmedical use) has been documented in several studies (Babcock & Byrne, 2002; Johnston, O'Malley, Bachman, & Schulenberg, 2007; Low & Gendaszek, 2002; McCabe, Knight, Teter, & Wechsler, 2005; Teter, McCabe, Boyd, & Guthrie, 2003; Teter, McCabe, Cranford, Boyd, & Guthrie, 2005; Teter, McCabe, LaGrange, Cranford, & Boyd, 2006; White, BeckerBlease, & Grace-Bishop, 2006). In a nationally representative sample of students attending 119 four-year colleges and universities, the past-year prevalence of

nonmedical use of prescription stimulants by undergraduates ranged from 0% to 25% and was 10% or higher at approximately 10% of colleges (McCabe et al., 2005). Risk factors for nonmedical use included being White, membership in a fraternity or sorority, a lower grade point average (GPA), higher rates of substance use and other risky behaviors, and attending more competitive colleges. The motives for nonmedical use most commonly reported were related to enhancing academic performance, although a substantial percentage of nonmedical users reported using stimulant medication to get high (Teter et al., 2005; Teter et al., 2006).

In the aforementioned summarized studies, the misuse of ADHD medications by students for whom it is prescribed was not considered separately from nonmedical use by students without prescriptions. Recently, however, researchers have begun to specifically examine the misuse of ADHD medications by students with prescriptions. In a survey study conducted at a public northeastern university, approximately 10% of students with a prescription for ADHD medication reported using it in ways that differed from how it had been prescribed (White et al., 2006). Information on the frequency and nature of this misuse was not provided, however. In another study at a public college in the southeast, 25% of students receiving medication for ADHD reported that they had used their ADHD medication to get high, and 29% reported giving or selling their medication to others (Upadhyaya, Rose, Wang, & Brady, 2005). In a study conducted at a large public midwestern research university, 55 of 178 (30.9%) students who used prescribed stimulant medications for ADHD in the past 12 months reported that they had also used someone else's stimulant medication during this time (McCabe, Teter, & Boyd, 2006). These students were more likely than other students with prescriptions to smoke, to binge drink, and to have used marijuana, cocaine, and ecstasy in the past year. Finally, in the only other study on this issue (to our knowledge), Wilens, Gignac, Swezey, Monuteaux, and Biederman (2006), reported that, among 55 young adults with an ADHD medication prescription, 22% had used their medication at higher doses than prescribed during the past 4 years, and 10% had gotten high on their medication. Misuse was concentrated among young adults with a concurrent diagnosis of conduct disorder or substance use disorder. It should be noted, however, that this sample was not composed exclusively of college students.

Although these studies provide important initial data on the misuse of prescribed ADHD medications by undergraduates, knowledge of this phenomenon is limited relative to what is known about the use of ADHD medications by students without prescriptions. Thus, although the motives and perceived consequences of nonmedical ADHD medication use have been examined in several reports (Rabiner, Anastopoulos, Costello, Hoyle, & Swartzwelder, 2008; Teter et al., 2005; Teter et al., 2006), these issues have not been carefully studied among students who misuse prescribed medication. In addition, apart from a single study in which drug and alcohol use was found to be higher among students who misused prescribed ADHD medications relative to those who did not (McCabe et al., 2006), little is known about whether the 1correlates of this behavior are similar to known correlates of nonmedical use (e.g., higher self-reported attention problems, participation in a fraternity or sorority, poorer academic performance). Here we report on a Web-based survey study of undergraduates at a public university and a private university in the southeastern United States, in which we begin to address these questions.

Method

Participants

Among 3,407 undergraduates attending a public university and a private university located in the southeastern United States who completed a Web-based survey designed to learn about the motives, correlates, and perceived consequences of nonmedical ADHD medication use, 115 students (3.4%) reported having a current prescription for ADHD medication. These are the students from whom data pertaining to the misuse of prescribed ADHD medication was obtained. The institutional review board at each university approved the study protocol, and all participating students provided informed consent online. The public university serves predominantly instate students and has a female-to-male student ratio of >2:1. The private university is highly selective, admits a more geographically diverse student body, and enrolls roughly equal numbers of male and female students. Details on the participation rate and demographic characteristics of the sample are provided later.

Measures

Survey overview. Information on factors that may be related to the nonmedical use of ADHD medications by college students, and the misuse of medication by students for whom it is prescribed, was collected from all 3,407 students who completed the survey. This included questions pertaining to drug and alcohol use, personality traits, ADHD symptoms, and academic concerns. A detailed inquiry about the possible misuse of medications prescribed to treat ADHD was limited to the 115 students who reported having a current prescription. Portions of the survey that are central to the present study are described later, and the questions pertaining to these areas represented approximately half the questions that participants who reported misusing ADHD medication were asked to complete. Because the survey was confidential and anonymous, motivations to provide deceptive responses were minimized, and items intended to assess social desirability or the truthfulness of their reports were not included.

Demographics. All students were asked to provide their gender, ethnicity, race, class standing, and whether they were members of a fraternity or sorority. They were also asked to report their current GPA.

ADHD medication misuse. A student was considered to have misused ADHD medication if he or she reported having taken a prescribed ADHD medication in higher doses than prescribed, more often than prescribed, or using someone else's ADHD medication since beginning college. Those that had were asked whether and how often they had done any of these during the past 6 months. Students were also asked whether and how often they had snorted or injected ADHD medication in the past 6 months. Students who reported taking ADHD medication without a prescription represent a different form of misuse (i.e., nonmedical use) and are not considered here.

Motivations for misusing ADHD medication. Students who reported ADHD medication misuse during the past 6 months were asked how often they had done so for each of the following reasons: to be able to concentrate better in class; to be able to concentrate better while studying; to feel less tired so that they could study longer; to feel less restless in class; to feel less restless while studying; to keep track of their assignments; to prevent others from having an academic edge over them; to feel better; to get high; to prolong the intoxicating effects of alcohol

or other substances; and to lose weight. Students rated each motive according to whether it was never, rarely, sometimes, often, or always a reason for their misuse.

Perceived effects of nonmedical ADHD medication use. Students were asked how often misusing ADHD medication helped them to do the following: concentrate better in class; concentrate better while studying; study longer; feel less restless in class; feel less restless while studying; keep better tracking of assignments; lose weight; feel better; and get high. Students indicated how frequently they experienced each effect on a 5-point scale ranging from never (1) to always (5). Students also rated the overall impact of misusing their ADHD medications on a scale ranging from 1 (very negative) to 5 (very positive).

Possible adverse consequences of misusing ADHD medication. Students reported on a range of potential side effects of ADHD medication misuse, including headaches, stomach aches, irritability, sadness, reduced appetite, sleep difficulty, dizziness, and difficulty getting along with friends. Consequences were rated on the aforementioned response scale. Students were also asked whether misusing ADHD medication had resulted in their having to see a physician, seek treatment in an emergency room, or seek treatment for substance abuse.

Use of ADHD medication with alcohol and other substances. All students reporting a prescription for ADHD medication were asked whether they had taken their medication with alcohol during the past 6 months. They were also asked whether and how often they had taken their medication with other substances such as marijuana or cocaine.

Diversion of ADHD medication. Students were asked how often during the past 6 months they had been asked by another student to sell or give them ADHD medications and how many times they had done so. Items on the response scale were never (1), 1–2 times (2), 3–5 times (3), 6–9 times (4), 10–19 times (5), 20–39 times (6), and 40+ times (7).

Characteristics of students who misuse ADHD medication. We were interested in whether factors known to be associated with the nonmedical use of ADHD medications, (i.e., use by students without a prescription) were also associated with the misuse of prescribed ADHD medications. The factors we considered, in addition to demographic information, are described later.

ADHD symptoms. In previous work, we found that students using ADHD medication without a prescription reported higher rates of ADHD symptoms than other students (Rabiner et al., 2008), and we wondered whether more severe ADHD symptoms would also contribute to medication misuse by students with prescriptions. Because ADHD symptoms in the Diagnostic and Statistical Manual of Mental Disorders (4th ed., text revision; American Psychiatric Association, 2000) may not adequately capture manifestations of ADHD in young adults (Barkley, Fischer, Smallish, & Fletcher, 2002), we developed items to measure inattentive and hyperactive-impulsive symptoms that are directly relevant to college students. The six-item Inattention scale included items inquiring about attention difficulties related to college academic tasks (e.g., “It is difficult for me to pay attention during classes,” “I believe that most students in my courses concentrate better in class than I do,” “I have difficulty keeping track of my different school assignments”). Students responded to each item using a 5-point scale ranging from

strongly disagree (1) to strongly agree (5); item responses were averaged so that higher scores indicate greater self-reported attention difficulties. In a previous study in which this scale was used, the alpha exceeded .90, and students with self-reported ADHD had significantly higher scores than other students (Rabiner et al., 2008). Alpha for the present sample was .92.

We assessed hyperactive–impulsive symptoms with five items selected to reflect the manifestation of such difficulties in college students (e.g., "I feel restless and fidgety during my classes," I feel restless and fidgety when completing schoolwork outside of class," "I am an impulsive person"). Item responses were averaged so that higher scores indicate greater self-reported attention difficulties. In a previous study using this measure, the coefficient alpha was .84, and students with self-reported ADHD had significantly higher scores than other students (Rabiner et al., 2008). The alpha for the present sample was .82.

Alcohol, tobacco, and drug use. Students were asked whether they had used alcohol, tobacco, marijuana, cocaine, or inhalants during the past 6 months. In addition to examining the use of these substances individually, we created a composite substance use variable by summing the number of substances that students reported using—this ranged from 0 to 5—and then standardizing this sum. Coefficient alpha for the scale was .71, indicating an adequate level of internal consistency.

Procedure

The survey was administered on the Web during the spring semester in 2007. At each university, data collection occurred over a 5-week period beginning approximately 6 weeks into the spring semester. Because data collection was part of a longitudinal study in which all students enrolled as freshmen during the previous fall semester had been recruited, and because we wanted to maximize the number of students for whom two waves of survey data were available, all current sophomores were invited to participate. In addition, 50% of the freshmen, juniors, and seniors at each university were randomly selected so that a cross-sectional sample of the different classes could be obtained. Here we focus on results from the cross-sectional sample.

Invitations to participate were sent by e-mail to 5,929 students at the public university and 3,896 students at the private university. The invitation assured students that their responses would remain confidential, that the researchers would not be able to not link individual students to their responses (students accessed the survey using a randomly generated ID number), and that a certificate of confidentiality had been obtained to protect their privacy. Participants were instructed to skip any question they did not wish to answer and to answer each item as honestly as they could. A $10 campus bookstore gift card was offered as an incentive to participate, and participants were also eligible to win one of ten $100 bookstore gift cards at each campus. Three additional invitations were sent at weekly intervals to students who neither responded nor opted out.

Completed surveys were obtained from 1,657 students from the public university (28%) and 1,750 students from the private university (45%). Across the two schools, the participation rate was 35%. Although this rate is lower than the 46% response rate obtained during the previous year's administration that involved exclusively freshmen (Rabiner et al., 2008), it is in the range of response rates attained for other recently published college-based studies of this issue (Babcock & Byrne, 2002; Low & Gendaszek, 2002; McCabe et al., 2005).

Results

Sample Characteristics

One hundred fifty-six students across the two schools—approximately 4.6% of the 3,407 students who completed the survey—reported that they were currently diagnosed with ADHD. This included 6.7% of students at the public university and 2.6% of students at the private university. Of students reporting an ADHD diagnosis, 115—about 74%—had a prescription for ADHD medication. The percentage of diagnosed students with a prescription was higher at the private university than at the public university (89% vs. 67%), $\chi^2 = 8.00$, $p < .01$. Seventy-nine of the students with a prescription were female, and 36 were male; this ratio, atypical for ADHD samples, reflects the fact that more students at the public university—where females constitute nearly 70% of the student body—reported an ADHD diagnosis. The percentage of females among students with a prescription for ADHD medication was essentially identical to the proportion of females in the larger sample of 3,390 respondents (69% vs. 66%), $\chi 2 = 0.33$, $p = .56$. Relative to the larger sample, White students were overrepresented among students with a prescription (85% vs. 67%), $\chi^2 = 15.75$, $p = .001$.

Because this article focuses on misuse of ADHD medication by students for whom it has been prescribed, it would be helpful to know whether students with prescriptions who chose to participate differed from students with prescriptions who opted not to complete the survey. It was not possible to determine this in a telephone follow-up survey of nonrespondents, however, because the participating universities had phone numbers on less than one third of enrolled students. This is probably because many students now have cell phones and do not register their numbers with the university. We also did not expect mailing surveys to nonrespondents to produce an adequate response rate.

Table 1 Frequency of ADHD Medication Misue in Past 6 Months (*n* = 26)

	Reported Frequency of Misuse						
Type of Misuse	Never	1–2	3–5	6–9	10–19	20–39	>40
Took medication more often than prescribed	8	7	5	3	3	0	0
Used a higher dose than prescribed	7	4	5	7	2	1	0
Used someone else's medication	10	9	6	0	0	1	0

Frequency of ADHD Medication Misuse

Of the 115 students with a current prescription for ADHD medication, 36 (31%) reported having taken their medicine more often than prescribed, at a higher dose than prescribed, or using someone else's medication since beginning college. The percentage of students with prescriptions for ADHD medication who had misused it did not differ by site (36% at the public university vs. 24% at the private university), $\chi 2 = 1.76$, $p = .18$. Medication misuse during the past 6 months was also consistent across the two sites and was reported by 27 (75%) of these students, including 8 students who had misused ADHD medication in one of these three ways, 8 who had misused it in two ways, and 10 who had misused it in all three ways (this sums to 26 because 1 student chose to skip these items). The frequency with which students engaged in these different types of misuse is shown in Table 1.

Nine of the 115 students with a prescription for ADHD medication—about 8%—reported snorting their medication during the past 6 months. All of these students reported doing this just once or twice. Surprisingly, only 3 of these 9 had also misused their medication by taking it more often than prescribed or in a larger dose than prescribed. Only 1 student reported that they had injected their medication in the past 6 months.

Diversion of ADHD Medication

Fifty-six percent of the 115 students with prescriptions reported being approached by a peer to give or sell them their medication in the past 6 months; this percentage was essentially identical across the two universities. Over 13% of students reported that they had been approached at least six times. Thirty students—26% of those with prescriptions—reported giving or selling their medication to a peer in the past 6 months. Once again, the rates at the two universities were essentially identical (26% at the public university vs. 28% at the private university). Twenty of these students had done this 1–2 times, 5 had done it 3–5 times, 3 had done it 6–9 times, and 2 had done it 10–19 times. Students who had misused ADHD medication were significantly more likely to divert their medication than those who had not (59% vs. 22%), $\chi^2 = 13.34$, $p < .001$. Five students reported that their medication had been stolen during the past 6 months.

Motivations for Misusing ADHD Medication

Table 2 shows how often students reported misusing their ADHD medication for a variety of different reasons; the reasons are listed in descending order according to how frequently each was reported to be either always or often the reason for misuse.

As seen in Table 2, the five reasons for which students most frequently reported misusing their ADHD medication center on enhancing academic performance and were reported to be often or always a reason for misuse by between 26% and 63% of misusers. Misusing medication to "feel better" was the most frequently reported nonacademic reason for misuse and was listed as often or always a reason for misuse by 6 of the 27 students (i.e., 22%). Misusing medication to get high, to prolong the effects of alcohol or other substances, to counteract the effects of other drugs, or to lose weight was rarely reported. Students' ratings of the reasons for misusing ADHD medication did not differ across the two universities.

We next assessed the proportion of students who used misused their ADHD medication purely for academic enhancement reasons, purely for nonacademic reasons, or for both sets of reasons. For this analysis, motives that a student rated as rarely, often, or always a reason for use were coded as present and those rated never were coded as absent. Students were categorized as using ADHD medication for academic reasons if any of the academically relevant motives were present, and as using for nonacademic reasons if any nonacademic motives were present. Fourteen of 27 students misused their ADHD medication exclusively for academic reasons, and the remaining 13 misused for both academic and nonacademic reasons. No student misused ADHD medication solely for nonacademic reasons. Results across the two universities were again highly consistent.

Table 2 Number of Students Endorsing Different Reasons for Misusing ADHD Medication (*n* = 27)

	Frequency of Misuse					
Reason for Misuse	Never	Rarely	Sometimes	Often	Always	% Often/Always
To concentrate better while studying	1	1	8	6	11	63
To be able to study longer	3	2	5	9	8	63
To feel less restless while studying	7	1	6	8	5	48
To concentrate better in class	8	5	5	7	2	33
To feel less restless in class	12	3	5	6	1	26
To feel better	15	3	3	5	1	22
To keep better track of assignments	13	4	6	4	0	15
To get high	25	1	0	0	1	4
To counteract the effects of other drugs	24	1	1	0	1	4
To lose weight	22	3	1	0	1	4
To prolong the intoxicating effects of alcohol or other substances	25	1	1	0	0	0

Table 3 Number of Students Experiencing Different Effects of Misusing ADHD Medication (*n* = 27)

	Frequency of Misuse					
Reported Effect: "Helped me . . ."	Never	Rarely	Sometimes	Often	Always	% Often/Always
Study longer	0	1	5	5	11	73
Concentrate better while studying	1	1	5	6	12	72
Feel less restless while studying	0	2	4	7	6	68
Feel better	0	0	3	5	1	66
Concentrate better in class	1	0	4	6	3	64
Keep better track of assignments	0	0	5	4	1	50
Feel less restless in class	0	2	3	3	4	47

Perceived Effects of Misusing ADHD Medication

To examine students' perception of how they were affected by misusing their ADHD medication, we asked about effects that were directly linked to the motives described earlier. For example, students had been asked how often they misused ADHD medication to get high, and we wanted to know how often they believed this effect was obtained. We limited our examination of each effect to those students who had reported misusing ADHD medication to obtain the particular effect at least sometimes. For example, if students indicated that they never or rarely misused ADHD medication to get high, we did not include their reports of how often using ADHD medication produced a high. This reflected our interest in learning how often students felt that misusing ADHD medication produced effects that they were more frequently motivated to attain. Results for this analysis are presented in Table 3.

Because the entries in Table 3 depend on the number of students who reported the corresponding motive for nonmedical ADHD medication use either sometimes, often, or always, the totals differ for each effect. Effects where 5 or fewer students rated the corresponding motive as occurring at least sometimes are not included because we felt the number of cases would be too small to be meaningful. As can be seen, across the different desired effects, between 47% and 73% of students reported that misusing their medication produced the effect either often or always.

Table 4 Percentage of Students Reporting Different Adverse Effects of Misusing Prescribed ADHD Medication (*n* = 27)

	% Students Reporting Effects of Misuse					
Reported Effect	Never	Rarely	Sometimes	Often	Always	S,O,T
Gave me headaches	37	11	44	7	0	51
Gave me stomachaches	44	37	7	11	0	18
Made me irritable	26	22	33	15	4	52
Made me sad	48	30	11	7	4	22
Reduced my appetite	7	19	30	22	22	74
Sleep difficulties	7	30	30	22	11	63
Made me dizzy/lightheaded	44	22	30	4	0	34
Led to social difficulties	48	37	4	11	0	15

Note: Values are rounded to nearest percentage. S,O,T = percentage reported the side effect either sometimes, often, or always.

Reports of Adverse Effects of Misusing ADHD Medication

Table 4 shows students' reports of various side effects they experienced from misusing ADHD medication. The final column in this table represents the percentage reporting that the side effect occurred either sometimes, often, or always. As can be seen, appetite reduction and sleep difficulties were the most common side effects and were reported to occur at least sometimes by 74% and 63%, respectively, of the students. In addition, over 50% of students reported experiencing irritability and headaches at least sometimes. The other adverse reactions were reported to occur by substantially fewer students.

Students were asked about several other potential adverse consequences of misusing ADHD medication. Only 2 students who misused ADHD medication felt that it contributed to their taking other medications that were not prescribed for them, and only 1 student felt that it contributed to their use of other drugs. One student reported that misusing ADHD medication resulted in their having to see a doctor and visit the emergency room.

Finally, students rated the overall impact of misusing ADHD medication on a scale ranging from 1 (very negative) to 5 (very positive). The average rating was 3.32, which is just above the scale midpoint. Only 4 students rated the overall effect of their misuse as very negative or negative; 11 rated it as either positive or very positive.

Use of ADHD Medication in Conjunction With Other Substances

Thirty-four (30%) of students with a prescription for ADHD medication had taken it with alcohol in the past 6 months, and 18 of these students had done so three or more times; rates at the two universities were not significantly different (34% at the public university vs. 24% at the private university), $\chi^2 = 1.03$, $p = .31$. Nineteen students (17%) indicated that they had taken medication in conjunction with marijuana. No student reported using ADHD medication along with cocaine.

Characteristics of Students Who Misuse Their ADHD Medication

We were also interested in how students who misused ADHD medication differed from those who did not. Rates of medication misuse did not differ according to whether students were in the Greek system ($\chi^2 = 0.002$, $p = .95$) or whether they were White ($\chi^2 = 0.006$, $p = .93$); because there were only 14 non-White students with a prescription for ADHD medication, the power to detect racial differences was limited. There was a trend for misuse to be more prevalent among juniors and seniors than among freshmen and sophomores (42% vs. 24%), $\chi^2 = 3.81$, $p < .06$.

Students who misused their medication did not report higher levels of attention difficulties than nonmisusers (3.98 vs. 3.75), $F(1, 104 = 1.39)$, $p = .24$; or lower GPAs, (3.00 vs. 2.98), $F(1, 104 = .01)$, $p = .83$. They did, however, tend to report higher rates of hyperactive–impulsive symptoms (3.49 vs. 3.13), $F(1, 104 = 3.65)$, $p < .06$.

We also examined whether students who misused ADHD medication had higher rates of substance use than nonmisusers. Misusers were more likely than nonmisusers to have consumed alcohol (97% vs. 77%), $\chi^2 = 6.71$, $p < .01$, and marijuana (53% vs. 27%), $\chi^2 = 6.76$, $p < .01$, during the past 6 months. Rates of cocaine use (9.4% vs. 6.6%) and cigarette use (45.7% vs. 30.7%) were in the same direction but were not significantly different. Not surprisingly, the average score for misusers on the composite substance use scale was significantly higher (2.75 vs. 2.17), $F(1,109) = 10.31$, $p < .01$.

Discussion

As reported in prior studies of undergraduate students with prescriptions for ADHD medication (McCabe et al., 2006; Upadhyaya et al., 2005), we found that although the majority take their medication as prescribed, a significant minority report misusing ADHD medication. In fact, nearly one third of students with a prescription for ADHD medication reported taking their medication more often than prescribed, at higher doses than prescribed, or using someone else's medication since beginning college. Although this is concerning, it is important to recognize that more than half the students who misused their ADHD medication did so exclusively to enhance their academic performance, with the three most frequently reported reasons centered on improving the ability to study: to concentrate better while studying, to be able to study longer, and to feel less restless while studying. Even among students who also reported using for nonacademic reasons (e.g., to get high), enhancing academic performance was still the most frequent reason for misuse. Furthermore, not a single student reported misusing their medication exclusively for nonacademic reasons. In general, students' motives for misusing prescribed ADHD medication were similar to the motives reported by students who take ADHD medication that has not been prescribed for them, that is, nonmedical users (Rabiner et al., 2008; Teter et al., 2005; Teter et al., 2006) and, like the majority of nonmedical users, most felt that it was generally effective in producing the desired result.

The fact that most misuse of prescribed ADHD medication is motivated by a desire to enhance academic functioning—particularly in relation to studying outside of class—suggests that many undergraduates with ADHD perceive their treatment to be less than optimally effective. For example, students who believe their symptoms are compromising their ability to study effectively may be inclined to experiment with taking higher doses of their medication. Other students may take extra doses to assist with late night studying, as even long-acting medications taken during the day are likely to have worn off by this time, which are prime study hours for many students. In future research, it will be important to gather specific prescription

information from students to examine whether those who use higher doses than prescribed tend to be "underdosed" from the start. It will also be interesting to determine whether the prescriptions written for college students typically address the need for symptom coverage that extends into the early morning hours when studying for exams and completing papers often occurs.

These issues relate to the more fundamental question of whether college students with ADHD benefit from medication treatment as it is typically provided. In the only previous study of this issue of which we are aware, no evidence that students with ADHD benefited from medication treatment was found (Rabiner et al., 2008). Another important issue raised by these results concerns the extent to which physicians are actively involved in monitoring the effectiveness of college students' medication treatment, and the degree to which physicians and students communicate around issues related to treatment adjustments. This is also important to examine in subsequent research.

Although most students misused their medication in an effort to perform better academically, other aspects of students' medication use are perhaps more concerning. Thus, nearly 8% had snorted their medication during the past 6 months, nearly 30% had used medication in conjunction with alcohol, and nearly 20% had taken medication with marijuana. A particularly concerning finding was that the majority (56%) of students with a prescription for ADHD medication had been approached to divert their medication during the past 6 months, and over 25% had done so; these findings are consistent with previous research on this issue (McCabe et al., 2006; Upadhyaya et al., 2005). Not surprisingly, diversion was more likely to occur among students who had misused medication themselves. These results underscore the need for physicians to discuss issues related to medication diversion with students and to contract with students about not diverting their medication.

Correlates of ADHD medication misuse were only partially consistent with those previously found to characterize students who use ADHD medication without a prescription (Rabiner et al., 2008; Teter et al., 2005; Teter et al., 2006). In contrast to what has been reported for nonmedical users, students with prescribed ADHD medication were not more likely to belong to a fraternity or sorority, to be White, to report higher rates of attention difficulties, or to have lower GPAs. Consistent with previous findings on nonmedical users, however, they reported greater impulsivity; were more likely to have used illicit drugs, alcohol, and tobacco during the past 6 months; and were more likely to be upperclassmen.

Although results from this study build on existing knowledge of the misuse of prescribed ADHD medication by college students, they should be regarded cautiously given that we sampled students from only two universities. Thus, the extent to which our findings generalize to a more representative sample of college students with prescriptions for ADHD medication is unknown. In addition, we have no way to determine what percentage of students with a prescription for ADHD medication chose to participate and whether those who did are representative of those who did not. Finally, because it was not possible to verify the accuracy of students' self-reported diagnosis, we cannot be certain that those who reported having ADHD would meet diagnostic criteria based on a comprehensive evaluation.

These limitations notwithstanding, results from this study suggest that the misuse of ADHD medication by college students for whom they are prescribed is not uncommon, that students who do so are primarily motivated by a desire to improve their academic performance specifically, to be able to study more effectively—and that most feel misusing medication is helpful for this purpose. Misuse is concentrated among students who are prone to consume other

drugs and alcohol, and these students are more likely to divert their medication to peers. College health officials and prescribing physicians may find these results useful in crafting both clinical and administrative decisions to address this issue. Because a desire to enhance academic functioning was clearly the most important reason for misusing ADHD medication, our findings highlight the need to carefully examine the effectiveness of ADHD medication treatment in college populations and whether typical prescribing patterns address the need that many students have for symptom coverage that spans when students are in classes during the day and through the early morning hours, when studying for exams and completing papers often occurs.

Authors' Note: This study was supported by NIDA Grant R21-DA018754. The authors gratefully acknowledge David Jamieson-Drake and Jiali Luo in the Duke University Office of Institutional Research Office for their assistance in implementing the Web-based survey used in this study. We also thank Lorrie Schmid for help with data management and Sean Esteban McCabe for his contribution to the development of the survey. Address correspondence to David L. Rabiner, Box 90545, Durham, NC 27707; e-mail: drabiner@duke.edu.

References

American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders (4th ed., text rev.). Washington, DC: Author.

Babcock, Q., & Byrne, T. (2000). Student perceptions of methylphenidate abuse at a public liberal arts college. Journal of American College Health, 49, 143-145.

Barkley, R. A., Fischer, M., Smallish, L., & Fletcher, K. (2002). The persistence of attention-deficit/hyperactivity disorder into young adulthood as a function of reporting source and definition of disorder. Journal of Abnormal Psychology, 111, 279-289.

Johnston, L. D., O'Malley, P. M., & Bachman, J. G., & Schulenberg, J. E. (2007). Monitoring the future: National survey results on drug use, 1975–2006. Volume II: College students and adults ages 19-45 (NIH Publication 07-6206). Bethesda, MD: National Institute on Drug Abuse. Available online at http://www.monitoringthefuture.org/pubs/monographs/vol2_2006.pdf.

Low, K. G., & Gendaszek, A. E. (2002). Illicit use of psychostimulants among college students: A preliminary study. Psychological Health and Medicine, 7, 283-287.

McCabe, S. E., Knight, J. R., Teter, C. J., & Wechsler, H. (2005). Non-medical use of prescription stimulants among U.S. college students: Prevalence and correlates from a national survey. Addiction, 100, 96-106.

McCabe, S. E., Teter, C. J., & Boyd, C. J. (2006). Medical use, illicit use, and diversion of prescription stimulant medication. Journal of Psychoactive Drugs, 38, 43-56.

Rabiner, D. L., Anastopoulos, A. D., Costello, J., Hoyle, R. H., & Swartzwelder, H. S. (2008). Adjustment to college in students with ADHD. Journal of Attention Disorders, 11(6), 689-699

Teter, C. J., McCabe, S. E., Boyd, C. J., & Guthrie, S. K. (2003). Illicit methylphenidate use in an undergraduate student sample: prevalence and risk factors. Pharmacotherapy, 23, 609-617.

Teter, C. J., McCabe, S. E., Cranford, J. A., Boyd, C. J., & Guthrie, S. K. (2005). Prevalence and motives for illicit use of prescription stimulants in an undergraduate student sample. Journal of American College Health, 53(6), 253-262.

Teter, C. J., McCabe, S. E., LaGrange, K., Cranford, J. A., & Boyd, C. J. (2006). Illicit use of specific prescription stimulants among college students: Prevalence, motives, and routes of administration. Pharmacotherapy, 26, 1501-1510.

Upadhyaya, H. P., Rose, K., Wang, W., & Brady, K. T. (2005). Attention-deficit/hyperactivity disorder, medication treatment, and substance use patterns among adolescents and young adults. Journal of Child and Adolescent Psychopharmacology, 15, 799-809.

White, B. P., Becker-Blease, K. A., & Grace-Bishop, K. (2006). Stimulant medication use, misuse, and abuse in an undergraduate and graduate student sample. Journal of American College Health, 54, 261-268.

Wilens, T. E., Gignac, M., Swezey, A., Monuteaux, M. C., & Biederman, J. (2006). Characteristics of adolescents and young adults with ADHD who divert or misuse their prescribed medications. Journal of the American Academy of Child and Adolescent Psychiatry, 45(4), 408-414.

David L. Rabiner, PhD, is a senior research scientist in the Center for Child and Family Policy and director of undergraduate studies in the Department of Psychology and Neuroscience at Duke University. His research interests focus on the contribution of attention problems to students' academic difficulties and interventions to assist children with attention difficulties.

Arthur D. Anastopoulos, PhD, is a professor in the Department of Psychology at the University of North Carolina at Greensboro, where he directs an ADHD clinic for children, adolescents, and adults. An active researcher, he has been an investigator on several federal and university-funded research grants, including a 5-year grant to study the genetic basis of ADHD in collaboration with researchers at Duke University.

E. Jane Costello, PhD, is the director of the Center for Developmental Epidemiology in the Department of Psychiatry and Behavioral Sciences at Duke University Medical Center. She joined the faculty of the University of Pittsburgh in 1978, soon becoming an assistant professor of both psychiatry and epidemiology, as well as the director of the Psychiatric Epidemiology Training Program. She achieved her PhD in psychology from the University of London in 1981. In 1988, she began her research at Duke University, where she is currently a professor of psychiatry and psychology.

Rick H. Hoyle, PhD, is a professor of psychology and neuroscience and associate director of the Center for Child and Family Policy at Duke University. His research interests include identity, self-regulation, and failures of impulse control.

Sean Esteban McCabe, PhD, MA, MSW, is a research associate professor at the Substance Abuse Research Center and the Institute for Research on Women and Gender at the University of Michigan. He is a nationally recognized scholar in the areas of Web-based data collection, epidemiology of prescription drug abuse, and collegiate substance abuse.

H. Scott Swartzwelder, PhD, is a professor of psychiatry and behavioral sciences at Duke University Medical Center and a senior research career scientist for the U.S. Department of

Veterans Affairs. He is a clinical neuropsychologist who studies the ways in which alcohol and other drugs interact with the brain and, in particular, with brain mechanisms of learning and memory during adolescence and early adulthood.