Nonmedical Use of Stimulants Among Medical Students

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Context: Proliferation of the use of psychopharmacologic drugs for the treatment of individuals with attention and behavior disorders has promoted discussion of the illicit use of such drugs to enhance academic performance. Previous research has focused on the use of such drugs by undergraduate students; however, inquiry into the nonmedical use of prescription stimulants by medical students is warranted because of the unique qualities of the medical school environment (including academic pressure, stress, and competition with peers) and the demographic characteristics common to many medical students.

Objective: To examine the nonmedical use of prescription stimulants among osteopathic medical students, focusing on such key associated variables as academic stress, social network connections, and use of other substances.

Methods: In 2012, first- and second-year students at a large osteopathic medical school were surveyed on the nonmedical use of prescription stimulants, stress, social networks, perceptions of drug use, and related topics. Data were compared with national data and assessed using analysis of variance and χ^2 statistical tests.

Results: A total of 380 students completed the survey. Of those, 56 (15.2%) reported using prescription stimulants nonmedically to help them study in medical school. This percentage is significantly higher than the national estimated rate of diagnosis of attention-deficit/hyperactivity disorder in similar populations ($t=3.72$, $P<.001$). Both positive perceptions of the nonmedical use of stimulants ($F=14.89$, $P<.001$) and the use of other substances ($\chi^2=18.00$, $P<.001$) were positively associated with the nonmedical use of stimulants. Social network connections did not positively predict use by medical students, and certain types of social connectivity had a negative association with use.

Conclusion: In contrast with research on undergraduate populations, addressing academic stress and feelings of competitiveness may not be viable strategies for mitigating nonmedical use of stimulants among medical students.

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The proliferation of psychopharmacologic drugs for the treatment of individuals with attention and behavior disorders such as attention-deficit/hyperactivity disorder (ADHD) has promoted discussion of the illicit use of such drugs in academic settings, where their use is often viewed as a means of academic performance enhancement and even a form of cheating. Research on the nonmedical use of stimulants in academic settings has focused on undergraduate student populations. Medical schools, however, have been slow to examine such use among their cohorts.[1] The unique qualities

of the medical school environment, including intense academic pressure, high levels of stress, and stiff competition among peers, warrant further examination of this issue. Additionally, the osteopathic values that underpin the whole-patient approach to care have a natural parallel in osteopathic medical education, where there is a need to promote positive coping skills as part of a student's professional development toward becoming a competent and well-balanced osteopathic physician.

A meta-analysis by Smith and Farah[1] showed that the lifetime prevalence of nonmedical use of prescription stimulants among postsecondary student populations ranged from 6.9% to 34.0%. Similarly, a systematic review reported that the rate of nonprescribed stimulant use among college students was between 5% and 35%.[2] These findings may reflect any number of differences in study design, including focusing inquiries on differing types of stimulants and using dissimilar strategies in the construction of surveys, particularly when attempting to elicit honest responses to questions about nonmedical use of stimulants. Reasons for stimulant use also vary, with recreational use proving to be an overwhelmingly popular reason among some student samples, whereas improved studying and concentration were more frequently cited by others.[1]

Across the literature, a pattern of variables associated with the nonmedical use of prescription stimulants is evident. Among student populations, higher levels of use have been noted among males, whites, and students who use other substances.[3-9] Other studies have found that the level of social stigma directed toward other users by survey respondents was relatively low, academic stress was a positive predictor of use, and use increased at colleges where admissions standards were more competitive.[7,10] The finding in one study[6] that Jewish religious affiliation was positively associated with nonmedical use of stimulants likely points toward a social network effect, a supposition supported by the positive association between fraternity or sorority affiliation and use.[5,6,8,11] It is possible that larger social networks confer higher degrees of access as well as increased opportunities to know other users, both of which positively predict use.[10,12]

The prevalence and predictors of nonmedical use of prescription stimulants among pharmacy, dental, and allied health students are similar to those among undergraduate students.[3,13] One study[14] found that 10% of students at an allopathic medical school reported using stimulants nonmedically in their lifetime. Users were more likely to be white, and they often reported enhancement of academic performance as their motivation for use.[14] Researchers found a similar proportion (8.7%) of nonmedical use of stimulants over the lifetime of medical students in an Iranian sample.[10]

The current study assesses the nonmedical use of prescription stimulants among medical students at a large osteopathic medical school in the Midwestern United States. In particular, we compared the rate of nonmedical use of prescription stimulants among our survey population with the national estimated rate of diagnosis of ADHD. In addition, we examined the correlates of the nonmedical use of stimulants, including stress, competitiveness, social network connections, use of other substances, and attitudes toward use.

On the basis of previous studies' findings and our informal impressions on nonmedical use of prescription stimulants, we formed the following hypotheses:

1. The proportion of individuals in the sample who use prescription stimulants nonmedically will be significantly greater than national estimates of the rate of diagnosis of ADHD. (Although we also used questions that measured the nonmedical use of prescription stimulants directly, hypothesis 1 precludes the possibility that our analysis will overlook individuals who negotiated the acquisition of prescription stimulants from legitimate sources despite lacking a true medical need. Because medical students may be especially likely to possess the knowledge and

skills required to successfully acquire legitimate prescriptions, testing the proportion of total use against an established target value was the best way to estimate the prevalence of nonmedical use. Although reliable rates of diagnosis of ADHD among medical students were not attainable, the age of the cohort in our study [primarily in the mid-20s], in relation to trends of increasing rates of diagnosis, suggested that our use of the national rate of diagnosis for comparison purposes provided a relatively high test value. Therefore, if our findings were statistically significant, we would have a reasonable level of confidence in our interpretation of them.)

2. Stress is positively associated with nonmedical use of prescription stimulants.
3. Competitiveness is positively associated with such use.
4. Having a larger social network is related to increased nonmedical use of prescription stimulants.
5. Negative perceptions of the nonmedical use of prescription stimulants are negatively correlated with such use. (Associating social stigma with a behavior intuitively predicts less engagement in that behavior. Conversely, engaging in a behavior may undermine the normally associated stigmas.)
6. Use of other substances is positively associated with the nonmedical use of prescription stimulants. (As found in other studies,[3-7] the use of other substances creates the perceptions by proxy that the nonmedical use of prescription stimulants is normal.[15,16])

Methods

During the spring semester of 2012, first- and second-year students at a large osteopathic medical school in the Midwestern United States were administered a 61-item survey immediately after didactic lecture sessions. Students were not informed in advance that the survey would be administered. Instructions, which were read to the students, guaranteed participants' anonymity. The institutional review and privacy board at the university approved the study protocol and waived the requirement for written documentation of consent.

Various assurances of anonymity that were included in the study design for ethical reasons were articulated to the participants. These assurances, along with several best practices for encouraging honest responses to threatening questions,[17] were meant to elicit more accurate survey responses. For example, an approved waiver of written documentation of consent may improve the willingness of students to answer sensitive questions.[17] Additionally, a short narrative (provided orally and as a coversheet to the survey) that preceded the questions about diagnosis not only indicated that the prevalence of stimulant use was increasing among young adults but also put forth the notion that stimulants promote functioning among young adults with ADHD. Although truthful, this narrative was primarily intended to mitigate a social desirability bias (eg, underreporting of deviant behavior). Similarly, written statements such as "Everyone finds medical school very difficult at times" prefaced some of the survey questions. These statements were designed to minimize feelings of deviance that might discourage honesty.

Outcome Measures

Age was measured categorically to protect anonymity (particularly of older respondents). Categories included ages 23 years or younger, 24 to 26 years, 27 to 29 years, and 30 years or older. Sex was measured as male or female.

Nonmedical Use of Stimulants

To assess students' medical and nonmedical use of stimulants, we included survey questions about whether students had ever received a diagnosis of "an attention deficit disorder" (use of this general term was intended to include anyone who had ever received a diagnosis on the ADHD spectrum) and whether they had a current prescription for a psychopharmacologic stimulant. The survey also included separate questions about whether respondents had ever used a prescription stimulant to help them study during medical school or during their undergraduate education. Using the responses to these questions, we were able to separate the students into 4 categories: nonusers without a diagnosis, users without a diagnosis, nonusers with a diagnosis, and users with a diagnosis. Although this "use-group" variable approximated general nonmedical use of prescription stimulants relative to diagnosis, we also tested our hypotheses using a dichotomous measure of whether the respondent used stimulants nonmedically to study during medical school. This variable did not differentiate students who had a legitimate diagnosis; however, conceptually, it more directly captured the contemporary use patterns of respondents and therefore was more directly responsive to the concerns of some hypotheses (eg, hypothesis 1).

World Health Organization Adult ADHD Self-Report Scale

The World Health Organization (WHO) Adult ADHD Self-Report Scale is a 6-item scale that was created as part of an effort by the WHO to ascertain the rates of undiagnosed ADHD among adults. The scale asks adults questions about remembering appointments, organization, detail orientation, procrastination, and fidgeting, as measured using 5 response categories ranging from "never" (0 points) to "very often" (4 points), for a total possible score range of 0 to 24.

Stress

To measure stress, we used the 10-item version of Cohen's Self-Perceived Stress Scale.[18] We modified the recall frame from "in the last month" to "last semester" to focus on the academic environment. The response options for these questions were consistent with Cohen's original scale, ranging from "never" (0 points) to "very often" (4 points), for a total possible score range of 0 to 40.

Competitiveness

Competitiveness was operationalized using a single item that asked, "On a scale of 1-10, how competitive do you feel like medical school is at [university]? That is, how much competitiveness is there among your class?" This question intentionally measured a subjective impression of competitiveness, because perception is more closely related to resulting behavior than is an objective assessment.

Social Network

The relationship between social network connections and nonmedical use of stimulants was estimated using several proxy measures. The first measure was distance from campus. The response choice of 1 mile or less identified students residing in student housing at the university. The second measure asked about the student's relationship to other individuals who used prescription stimulants nonmedically, with the final categories rank-ordered for proximity as follows: (1) close friend or roommate, (2) acquaintance, or (3) "I know no one." Finally, because religious participation can be used as a proxy measure for social integration, religious service attendance was measured using 9 possible gradations that ranged from "never" (0 points) to "several times a week" (8 points).[19]

Use of Other Substances

Use of other substances was measured based on student responses to 4 questions, including ordinal measures of tobacco and alcohol use and open-ended, self-reported measures of the use of marijuana and other illicit substances. A dichotomous variable that assessed the use of any other substances was created for our analysis based on these questions; however, scores for the ordinal measures of tobacco and alcohol use were also combined with data on the frequency of use of marijuana and other illicit drugs to create a scale measure of other substance use. Total possible score ranged from 0 to 8.

Perception of Nonmedical Use of Stimulants

We created an approval scale based on 4 forced-choice questions, using a 4-item Likert scale to record responses ranging from "strongly agree" (4 points) to "strongly disagree" (1 point). The items prompted responses about the acceptability of using prescription stimulants nonmedically, the equivalence of such use with other forms of cheating, and so on. The possible total range for the scale was 4 to 16. Perceived prevalence served as a proxy for perceptions that the nonmedical use of stimulants was normal. On the basis of response frequencies, we then dichotomized this measure as less than 50 and more than 50 (where 50 represented approximately 20% of a given cohort).

Statistical Analysis

Surveys with 1 page or more of unanswered items were disregarded. Missing items were coded as missing and those cases were not included in any relevant analyses. Hypotheses were tested using analysis of variance and χ^2 statistical tests. Statistical significance was set a priori at $\alpha = .05$, and all analyses were performed with SPSS statistical software (version 19.1, SPSS Inc).

Because estimates of the prevalence of lifetime use in the age group assessed in the present study were not derived from larger epidemiologic analyses, for the initial test of use prevalence, we used as a comparison value the 2011 estimate of the prevalence of ADHD (8.4%) among 3- to 17-year-olds, as calculated by the US Centers for Disease Control and Prevention. Given that rates of diagnosis of ADHD are increasing, and given that diagnosis occurs most frequently in younger populations, use of this prevalence rate theoretically would indicate an overestimation of the prevalence of ADHD in our study population, who would have been at least 20 years old in 2010, when the Centers for Disease Control and Prevention collected their data.

Results

Of 499 first- and second-year osteopathic medical students enrolled at the time of the study, 380 completed the survey, yielding a response rate of 76.2% relative to total enrollment. However, because class attendance was not taken on the days when the survey was administered, it is likely that the response rate relative to the number of students present was even higher. Eleven surveys were omitted from our analysis because they were not complete (ie, 1 full page or more was not completed), resulting in a final data set of 369 cases for analysis. The study sample comprised 224 males (60.7%), 196 first-year students (53.1%), and 173 second-year students (46.9%).

Forty-seven respondents (12.7%) reported having previously received a diagnosis of ADHD, whereas 34 (9.2%) reported having a current prescription for ADHD medication. One-half of those who had a current prescription reported taking their medication daily, whereas the other half reported taking medication as needed. A total of 82 respondents (22.2%) reported using prescription stimulants nonmedically to help them study either during their undergraduate career (60 students [16.3%]) or during medical school (56 students [15.2%]). The joint categories of use and diagnosis yielded the frequencies shown in *Table 1*. Differences between use group scores on the WHO Adult ADHD Self-Report Scale (*Table 2*) were statistically significant ($F = 8.74$, $P < .001$).

Table 1.
Comparison of Joint Categories of Use and Diagnosis in a Study of the Nonmedical Use of Prescription Stimulants Among Osteopathic Medical Students (N=369)[a]

Use Group	No (%)
Nonusers	
Without an ADHD diagnosis	274 (74.3)
With an ADHD diagnosis	8 (2.2)
Users	
Without an ADHD diagnosis	42 (11.4)
With an ADHD diagnosis	37 (10.0)

[a] Data for items related to this variable were missing for 8 students included in the final sample; these students were not included in this analysis.

Abbreviation: ADHD, attention-deficit/hyperactivity disorder.

Post hoc analysis revealed a statistically significant difference between users with a diagnosis of ADHD and both of the groups without a diagnosis. This finding suggests that the symptoms experienced by users without a diagnosis were closer in kind to those experienced by nonusers without a diagnosis than by users with an actual diagnosis.

Tests of Hypotheses

Hypothesis 1 stated that the number of medical students who used prescription stimulants nonmedically would be statistically significantly greater than the national rate of diagnosis of ADHD. Hypothesis 1 was supported by our results. The percentage of students who used prescription stimulants nonmedically to study in osteopathic medical school was significantly higher than 8.4%, at 15.2% (t=3.72, P<.001), and the percentage of students who had ever used prescription stimulants nonmedically to enhance study (ie, during undergraduate school and medical school combined) was 20.3% (t=5.78, P<.001). Interestingly, the rate of diagnosis among students in the sample also was significantly higher than the national estimate, at 12.7% (t=2.50, P<.001).

Our analyses failed to support hypotheses 2 and 3, which examined stress and feelings of competitiveness, respectively. In fact, nonusers without a diagnosis had the highest average competitiveness rating (6.6), although the mean (SD) competitiveness rating (6.55 [1.77]) was statistically equivalent across all groups. The mean (SD) for the stress scale was 17.32 (6.35), and the scale had a Cronbach α correlation coefficient of .804 in our sample. However, stress showed no association with use. After conducting initial tests of the scale versions of these variables, we recoded them in various ways to examine the possibility of threshold-dependent associations. We included dichotomous coding of high- and low-stress groups in our recoding, in addition to testing other ways of partitioning the sample. Statistically significant associations with nonmedical use of prescription stimulants did not emerge.

Hypothesis 4 examined the association between use and several proxy variables of social network connection. The 164 students living in student housing comprised 43.9% of the sample, but no statistically significant association with use was noted for this group. Similarly, proximity to another user was not associated with the 4 use-group categories. However, using prescription stimulants nonmedically to study during medical school had a joint occurrence with having a close friend or roommate who used stimulants nonmedically (χ^2=6.41, P<.05). Finally, categorization as a nonuser without a diagnosis was significantly associated with more frequent attendance at religious services (F=3.40, P<.05). Similarly, students who used prescription stimulants nonmedically to help them study during medical school had significantly lower attendance at religious services (F=7.99, P<.01).

Hypothesis 5 predicted that perception of use would be associated with use itself. The 4 items on the approval scale had a Cronbach α correlation coefficient of .792, and the mean (SD) score on this scale was 8.28 (2.57). These findings indicated that respondents were more disapproving than approving of nonmedical use of stim-

ulants, because the middle score on the approval scale was 10.0. Approval of use was significantly associated with nonmedical use of stimulants; users were found to express more approval than nonusers ($F=14.89$, $P<.001$). Post hoc analysis showed that both users with a diagnosis and users without a diagnosis reported substantially greater approval of use (mean score, 9.50 and 10.22, respectively) than nonusers without a diagnosis (mean score, 7.83). A χ^2 test examining perceived prevalence and nonmedical use of stimulants to study during medical school revealed a statistically significant association ($\chi^2=7.54$, $P<.01$). In other words, users were more likely than nonusers to believe that nonmedical use of stimulants was more prevalent or normal.

Hypothesis 6 examined whether the use of other substances is associated with the nonmedical use of prescription stimulants. Results were significant for both the dichotomous variable measuring use of any other substance ($\chi^2=18.00$, $P<.001$) and the scale measure ($F=13.05$, $P<.001$). Users without a diagnosis had a substantially higher than expected frequency of responding yes to the measure assessing use of other substances. Post hoc analysis of the scale measure revealed substantial differences between users without a diagnosis and nonusers without a diagnosis.

Table 2.
Scores on the WHO Adult ADHD Self-Report Scale,[a] by Joint Categories of Use and Diagnosis (N=369)

Use Group	Mean (SD)
Nonusers	
Without an ADHD diagnosis	9.94 (3.62)
With an ADHD diagnosis	10.75 (1.49)
Users	
Without an ADHD diagnosis	10.83 (3.86)
With an ADHD diagnosis	13.29 (3.88)
Total	10.39

[a] The World Health Organization (WHO) Adult Attention-Deficit/Hyperactivity Disorder (ADHD) Self-Report Scale consists of 6 items with 5 response options ranging from "never" (0 points) to "very often" (4 points), for a total possible score range of 0 to 24.

Discussion

Although the results of the present study were derived from data on students at a single osteopathic medical school in the Midwestern United States, they represent an initial but informative step forward in increasing our understanding of the nature of nonmedical use of prescription stimulants by medical students. The results not only reveal how the characteristics of medical students may be similar to those of previously studied undergraduate populations but also, more importantly, how such characteristics may differ from those of previously studied populations. Measuring the nonmedical use of stimulants is not as straightforward as separating users with a diagnosis from users without a diagnosis. This likely is especially true when assessing medical students; however, the use-group variable in the present study appears to reasonably discriminate between the 2 groups. First, the percentage of users without a diagnosis (11.4%) is consistent with findings from previous studies.[1] In addition, the rate of diagnosis was statistically higher than the population parameter. These findings suggest that some individuals are indeed acquiring prescriptions that are not entirely medically indicated. Also, in the same sample, the percentage of students who used prescription stimulants nonmedically to study during medical school was 15.2%, a result that likely included some individuals with an ADHD diagnosis. Thus, the use-group variable and the variable measuring the use of stimulants to enhance study during medical school appear to be most helpful when used in tandem; however, they largely reflect the same statistical associations in the analyses. Finally, although it has been suggested that the nonmedical use of prescription stimulants may be a form of self-treatment,[20] scores on the WHO Adult ADHD Self-

Report Scale for users without a diagnosis are similar to those for nonusers, and they are significantly different from scores for users with a diagnosis. This finding suggests the existence of a substantial rate of genuinely nonmedical use of prescription stimulants among this group.

Although it is somewhat surprising that stress and competitiveness were not associated with use, as has been suggested by other studies, the uniqueness of the medical school environment may help to explain this finding. To begin with, although stress levels are relatively high among all medical students, stress levels may vary more widely among undergraduate students. This finding may be because the curriculum of undergraduate students often involves an array of study programs with varying levels of rigor and because, as a group, these students may be at more disparate stages of life, with varying associated levels of pressure. Medical students, on the other hand, experience a more pervasively and consistently stressed environment, particularly in light of the relative homogeneity of their curriculum. Thus, although more research is needed, stress and competitiveness do not appear to be viable factors for predicting the nonmedical use of stimulants among medical students, although they may well be such factors in undergraduate populations.

In previous studies, membership in a fraternity or sorority and knowing another user both had positive associations with the nonmedical use of prescription stimulants.[5,8,11,13] However, in the present study, the variables used as proxy measures for the hypothesis regarding social network effects had either no association with use of nonmedical stimulants or, as in the case of attendance at religious services, a negative association. Associations with groups that provide positive social support (either religious or secular) may provide a buffer against use rather than promote it. In turn, expansion of social support organizations may be a key strategy for universities seeking to address this problem. Of course, students who more frequently attend religious services may be less prone to admitting deviant behavior. Indeed, among students who did not use other substances (including tobacco and alcohol), the mean (SD) score for attendance at religious services was 3.82 (2.65), compared with 3.07 (2.32) ($F=6.95$, $P<.01$) for students who did use other substances. However, when we examined the analyses according to substance use, attendance at religious services was also predictive of the dichotomous variable that measured any alcohol use ($F=5.82$, $P<.05$). Whereas some consumption of alcohol is not considered a particularly deviant behavior, it nonetheless is reported at a lower rate among those who attend religious services more frequently. In addition, the social stigma associated with tobacco use is likely to be more severe than that associated with alcohol use, particularly among medical students. Alcohol use had no association with attendance at religious services, however ($F=1.90$, $P>.05$). Both nonmedical use of stimulants and use of other substances may simply be lower among students who attend religious services more frequently. Of course, the extent to which this finding is an effect of the existence of larger social networks among students who either participate more frequently in religious services or have religious values that mitigate unethical behavior remains unclear from these results.

The 2 factors that were positively associated with nonmedical use of prescription stimulants among medical students were less negative perceptions of use and use of other substances. Data from the present study indicate that these factors are the most reliable identifiers of potential nonmedical use of stimulants among students, likely because of underlying dispositions toward substance use and risk-taking behavior in general.[21] In other words, when lifestyles represent collections of behaviors that are patterned on the basis of underlying cognitive patterns, dispositions toward risk-taking promote a variety of kinds of substance use. Initial support for this explanation can be derived both from the higher rate of users without a diagnosis among males compared with females ($\chi^2=10.72$, $P<.05$), and the higher rate of students who used stimulants nonmedically to study

(χ^2=6.79, P<.01). These observations mirror findings from previous studies and likely reflect the fact that the underlying dispositions toward risk taking that are generally associated with substance abuse are more prevalent among males.[22]

From an institutional standpoint, our research represents an initial step in crafting policies and practices that will be responsive to the nonmedical use of prescription stimulants by medical school students. Although addressing academic stress and feelings of competitiveness might generally be a good practice, it may not mitigate the nonmedical use of stimulants. Rather, programs aimed at substance use generally—and identification of and intervention for substance users specifically—may represent a better approach. In addition, because having less negative perceptions of the nonmedical use of stimulants for the purpose of enhancing academic performance is strongly associated with use itself, programs and presentations that address the problems associated with nonmedical use of stimulants in the academic setting may be beneficial.

When perceptions of use are associated with use itself, institutional policies hinge to some extent on whether the nonmedical use of stimulants for academic purposes actually improves academic performance. The review by Smith and Farah[1] suggests that nonmedical use of stimulants may indeed improve declarative memory (ie, recall and retention of information), but even where positive results of such use are seen, the effect sizes are small enough to raise questions about whether the results are practically useful for any particular individual. This information would be an important component of any program addressing the issue. Moreover, the extent to which the medical curriculum can include critical thinking and practicum-based learning while requiring relatively less memorization might attenuate any advantages that users of stimulants receive. In addition, nonmedical use of prescription stimulants appears to be associated with health consequences, particularly regarding changes in normal levels of dopamine and norepinephrine in users without a diagnosis. Presentation of this information may help shift perceptions in ways that mitigate actual use.

Limitations

Although the response rate in the present study was excellent, and although analysis of the prevalence of nonmedical use of stimulants reasonably suggested external validity and generalizability of the results, several limitations of the study are worth noting. To start with, the present study was conducted at a single university, where the racial composition of the student population was overwhelmingly white. Because the rate of diagnosis of ADHD in white populations tends to be slightly higher than the national average rate,[23] the racial composition of our university is a limitation. In addition, the relatively high socioeconomic status of medical students may promote higher rates of diagnosis in this group. This limitation is mitigated by our use-group variable, which separates individuals who use stimulants for nonmedical indications, but it is still worth considering. Finally, analysis of a parent's income bracket and use group shows no unexpectedly higher joint occurrence.

Another limitation concerns underreporting, which is a common limitation of nearly all research on deviant behavior. Underreporting was of particular concern when attendance at religious services was salient in the analysis, but the previously mentioned post hoc analyses of attendance at religious services and substance use mitigated this concern. Moreover, the various assurances of anonymity built into the protocol appear to have elicited relatively honest responses. More generally, approximately one-quarter of the total number of first- and second-year students enrolled at the osteopathic medical school did not take the survey. Although, for some students, failure to take the survey was the incidental by-product of their not being in class on the day when the survey was administered, other students likely had an additional component of intentional avoidance. Nonetheless, the rates of stimulant use reported by students in the

present study were comparable to those noted in previous studies. In addition, according to unpublished university data, 2.5% of students from our study population reported nonmedical use of stimulants at the time of entrance to the university, indicating that our study was somewhat successful at eliciting honest survey responses from students. Thus, we have reason to feel confident that the reported rate of use is at least useful for the analysis of associations at the core of the present study, even if it is short of the actual rate of use.

Finally, measures of social networks in the present study were relatively crude. As noted, a more comprehensive analysis of social networks was not possible given that our sample came from a single university, thereby making protecting the anonymity of respondents more difficult. Given that previous research[5,6,8,11] has shown a positive association between nonmedical use of stimulants and membership in a fraternity or sorority, a more finely tuned exploration into a variety of social groups in the medical school environment would be beneficial for future research.

Future Research

Our findings on the patterns of nonmedical use of prescription stimulants among medical students diverge in critical ways from those noted in undergraduate student populations. In particular, stress and competitiveness were not associated with prescription stimulant use for nonmedical purposes in our population, as they were in undergraduate populations.[7,10] The issue therefore deserves to be the focus of more targeted study. In particular, future research ought to explore in more detail the hypothesis regarding social network connections. Although an actual cluster analysis of social network connections may be difficult to perform, the role of social connections can be further explored through inquiry into other kinds of social group memberships, particularly associations that are unique to the medical school environment. In addition, future research should address the limitations of the present study, in particular by using a wider sampling frame to improve the generalizability of the results. Finally, monitoring patterns of use longitudinally, starting from the years before clinical practice and moving through the years of clinical rotations, residency, and beyond, will be difficult but also highly informative.

Conclusion

Medical students do not appear to manifest all of the same characteristics exhibited by those in other populations who use stimulants for nonmedical purposes. Although more research is needed, the present study contributes to an understanding of the patterns and predictors of use among medical students in a way that can inform institutional practices that address the issue. This understanding is especially important because the holistic sensibilities of osteopathic medicine, particularly with regard to the whole-patient approach to care, would seem to naturally encourage an educational environment in which both the personal and professional development of osteopathic medical students are supported.

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