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Correlates of nonmedical use of prescription benzodiazepine anxiolytics: results from a national survey of U.S. college students

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Abstract

This study examined the prevalence and correlates associated with the nonmedical use of prescription benzodiazepine anxiolytics among U.S. college students. This study analyzed data from a nationally representative sample of 10,904 randomly selected students attending 119, 4-year U.S. colleges in 2001. The lifetime prevalence of nonmedical prescription benzodiazepine anxiolytic use was 7.8%, past year prevalence was 4.5% and past month was 1.6%. Past year rates of nonmedical use of prescription anxiolytics ranged from zero percent at the lowest use schools to 20% at the highest use school. Multivariate regression analyses indicated nonmedical use was more likely to occur among college students who were White, had both male and female sex partners and reported higher rates of substance use and other risky behaviors. In addition, nonmedical use of prescription benzodiazepine anxiolytics was less likely to occur among college students who attended college in the North Central region of the U.S. or historically black colleges and universities (HBCUs). This study provides evidence that the nonmedical use of prescription benzodiazepine anxiolytics represents a problem on some college campuses and among certain subgroups of U.S. college students. These findings have important implications for developing prevention efforts aimed at reducing the nonmedical use of prescription benzodiazepine anxiolytics among college students while not hindering the effective clinical treatment for various anxiety disorders.

Keywords

Benzodiazepines; Anxiolytics; Nonmedical use; College students; Correlates

1. Introduction

National epidemiological studies, national surveillance reports and college-based studies provide strong evidence that the nonmedical use of prescription benzodiazepine anxiolytics is increasing among young adults and college students in the U.S. (e.g., Johnston et al., 2003a,b; Mohler-Kuo et al., 2003; SAMHSA, 2002a, 2003a). Recent research indicates that the nonmedical use of prescription benzodiazepine anxiolytics among college students is at its highest level in the past two decades and one in every 10 college students report nonmedical use of these drugs in their lifetime (e.g., Gledhill-Hoyt et al., 2000; Mohler-Kuo et al., 2003; Johnston et al., 2003a). Furthermore, there is evidence that the nonmedical use of benzodiazepines is also occurring among adolescents and young adults internationally (e.g., Hibell et al., 2000; Karam et al., 2000; Lieb et al., 1998).

Benzodiazepines are the most widely used anxiolytic medications due to their well-established efficacy in the treatment of anxiety disorders (Augustin, 2001). There has been a recent increase

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in the U.S. prescription rates for benzodiazepines in general (Pincus et al., 1998) and for benzodiazepine anxiolytics among youths 20 years and younger specifically (Zito et al., 2003). The trend in prescription rates of medications is relevant to the discussion of prescription drug abuse because an increase in prescription rates may increase the likelihood that these medications will be misused (Zacny et al., 2003). Despite the effectiveness for treating symptoms of various conditions, the increase in prescription rates for benzodiazepine anxiolytics has raised public health concerns because of the high degree of abuse potential of these medications (Griffiths and Weerts, 1997) and the ongoing increase in nonmedical use of benzodiazepine anxiolytics among adolescents and young adults (Gledhill-Hoyt et al., 2000; Johnston et al., 2003a; Mohler-Kuo et al., 2003; SAMHSA, 2002a).

The Monitoring the Future Study (MTF) examines a nationally representative sample of U.S. high school seniors each year and tracks a sub-sample following high school. Johnston et al. (2003a) found that there has been a steady increase in the nonmedical use of benzodiazepine anxiolytics among college students aged 19–22 and past year nonmedical use has more than doubled between 1994 and 2001 (1.8% and 5.1%, respectively). Similarly, *The Harvard School of Public Health College Alcohol Study* (CAS) reported the past year nonmedical use of benzodiazepine anxiolytics more than doubled between 1993 and 2001 (1.8% and 4.5%, respectively) in the past decade among U.S. college students (Mohler-Kuo et al., 2003). *The National Survey on Drug Use and Health* (NSDUH), formerly known as *The National Household Survey on Drug Abuse* (NHSDA), collects data on incidence and prevalence of drugs each year within a randomized sample of general U.S. households, including college students who reside in dormitories. According to the 2001 NHSDA data, young adults 18–25 years of age reported the highest prevalence of nonmedical use of prescription drugs (SAMHSA, 2002b). The lifetime nonmedical use of several benzodiazepine anxiolytics increased significantly (e.g., Valium from 5.4% to 6.3%) between 2000 and 2001 among those U.S. young adults 18–25 years of age (SAMHSA, 2002b). *The Drug Abuse Warning Network* (DAWN) also suggests that there has been a recent increase in the abuse of prescription benzodiazepine anxiolytics. DAWN, a national surveillance system that monitors trends in drug-related emergency department (ED) visits and deaths, serves as an indicator of the harmful consequences associated with the nonmedical use of benzodiazepine anxiolytics. According to DAWN data, ED mentions of benzodiazepines significantly increased (38%) from 1995 to 2002. In particular, mentions of alprazolam (Xanax) increased 62% over the same time frame and mentions of clonazepam (Klonopin) increased 33% (SAMHSA, 2003a). While these national reports clearly provide valuable information regarding the prevalence and consequences of this form of drug abuse, unfortunately, they provide a limited understanding of the correlates associated with the nonmedical use of benzodiazepines anxiolytics. In particular, these studies did not examine several important individual-level and college-level characteristics that have been shown to be significantly associated with alcohol and other drug use such as fraternity and sorority membership, historically black college and university status (HBCU) and geographical region (e.g., Bell et al., 1997; Gledhill-Hoyt et al., 2000; Meilman et al., 1995; Strote et al., 2002).

Although reports of the abuse of benzodiazepines are few in number and no experimental, epidemiologic, or case report provides compelling evidence of addiction to benzodiazepines (Woods et al., 1988), there have been clinical observations suggesting that benzodiazepines are used non-medically for their psychoactive effects (i.e., to get high); that they are bought and sold illicitly; and that they are usually abused in combination with other drugs (e.g., Reynaud et al., 1998; Sellers et al., 1993; Sheehan et al., 1991). For instance, Sheehan et al. (1991) describe two cases of young adults who intranasally abused benzodiazepines, one of which used in combination with cocaine to lessen the stimulatory side effects of the cocaine. Thus, a comprehensive assessment of nonmedical benzodiazepine anxiolytic use—one which

includes an examination of polydrug use—is clearly necessary in order to fully understand the extensiveness of this drug use behavior on college campuses.

Information concerning the prevalence and correlates associated with the nonmedical use of prescription benzodiazepine anxiolytics among U.S. college students remains very limited as compared to what is known about heavy drinking and other drug use behaviors (e.g., Bell et al., 1997; Gfroerer et al., 1997; Johnston et al., 2003a; O'Malley and Johnston, 2002; Strote et al., 2002; Wechsler et al., 2002). To date, most college-based studies that have examined prescription drug abuse have focused on the nonmedical use of prescription stimulants such as methylphenidate (e.g., Babcock and Byrne, 2000; Low and Gendaszek, 2002; Teter et al., 2003). To date, there have been no studies that have examined factors associated with the nonmedical use of prescription benzodiazepine anxiolytics within a nationally representative sample of U.S. college students. Therefore, little is known about the characteristics of those individuals most at risk for nonmedical use of prescription benzodiazepine anxiolytics. If health professionals are to develop evidence-based prevention and treatment practices to reduce the nonmedical use of benzodiazepine anxiolytics, more information about the characteristics associated with this form of prescription drug abuse is clearly needed. The purpose of the present study was to assess the prevalence of nonmedical use of prescription benzodiazepine anxiolytics within a large representative sample of college students and determine the risk for non-medical use in terms of student and college characteristics and other substance use behaviors.

2. Methods

2.1. Study population and data collection

The present study used data from the 2001 Harvard School of Public Health College Alcohol Study (CAS) survey of 119 U.S. 4-year colleges and universities in 39 states. The participating schools were selected from the American Council on Education's list of all accredited 4-year U.S. colleges and universities with the exception of seminary schools, military schools, and allied health schools. An administrator from each college or university provided a random sample of 215 college students. Questionnaires were mailed to students beginning in February. Three subsequent mailings, usually 10 days apart, were sent to students: a reminder postcard, a second questionnaire, and a second reminder postcard. Mailing schedules were slightly different for some schools to avoid the period immediately preceding and following spring break. Student responses to the survey were voluntary and anonymous, and students were told they did not have to answer any question that made them feel uncomfortable. To increase response rate, cash prizes were offered to students who entered a drawing. One school was excluded because the response rate was considerably lower than the other 119 schools. A total of 10,904 students returned questionnaires, yielding an overall response rate of approximately 52% (range 22–86%). Response rate was not associated with the main outcome variable (i.e., the Pearson correlation coefficient between the non-medical use of prescription benzodiazepine anxiolytics and the response rate at the college-level was 0.04 in absolute value with $p = 0.642$). Consistent with previous studies, the data were weighted based on gender, age, and race in order to be more representative of each school. The response rates in these demographic groups at each college were used in the calculation of the overall sampling weights for the individual students so that responding students could account for the students having similar demographic characteristics who did not respond to the survey. Weighting was used to ensure that the demographic distribution of the sample was equivalent to the demographic distribution of the school population. Study design and procedures are described in more detail elsewhere (Wechsler et al., 2002).

The final sample of 119 colleges closely resembled the U.S. distribution of students enrolled full-time at 4-year colleges and universities (Knapp et al., 2004). Sixty-nine percent of students

in the present study attended public institutions and 31% attended private institutions. Sixty-nine percent of students attended schools in medium- to large-sized cities and 31% attended colleges in small towns and rural areas. Eighty-seven percent of students attended non-religiously affiliated colleges and 13% attended religiously-affiliated schools. Forty-seven percent of students attended 198 large institutions (>10,000 students), 23% medium-sized institutions (5,001–10,000 students), and 29% small institutions (1,000–5,000 students). Twenty-three percent of students attended schools located in the Northeast, 29% in the South, 30% in the North Central, and 18% in the West. Finally, five percent of students attended women's colleges and 2% attended historically black colleges and universities (HBCUs). Importantly, response rates did not differ by any key college-level characteristics (e.g., geographical region and HBCU status).

2.2. Measures

2.2.1. Nonmedical use of prescription benzodiazepine anxiolytics—Respondents were asked "How often, if ever, have you used any of the drugs listed below? Do not include anything you used under a doctor's orders." Drug items included "Tranquilizers (prescription-type drugs like Valium, Librium, Xanax, Ativan and Klonopin)". The response scale was (1) never used; (2) used, but not in the past 12 months; (3) used, but not in the past 30 days; and (4) used in the past 30 days.

2.2.2. Cigarette use—Respondents were asked "How often, if ever, have you used any of the drugs listed below? Do not include anything you used under a doctor's orders." Drug items included "cigarettes." The response scale for cigarette smoking was the same as that for nonmedical use of prescription benzodiazepine anxiolytics.

2.2.3. Alcohol use—Heavy episodic drinking (or binge drinking) is defined as the consumption of at least five drinks in a row for men and at least four drinks in a row for women during the 2 weeks preceding completion of the questionnaire (Wechsler et al., 1995). *Frequent binge drinking* was defined as having three or more binge drinking episodes in the past 2 weeks.

2.2.4. Illicit drug use—Respondents were asked "How often, if ever, have you used any of the drugs listed below? Do not include anything you used under a doctor's orders." Drug items included marijuana, cocaine, ecstasy (MDMA), prescription stimulants (Ritalin, Dexedrine, or Adderall), and prescription opioid analgesics (e.g., codeine, morphine, Demerol, Percodan, Percocet, Vicodin, Darvon, Darvocet). The response scale for each of these drugs was the same as that for nonmedical use of prescription benzodiazepine anxiolytics.

2.3. Data analysis

Data analysis included 10,904 student respondents from 119 4-year colleges. Statistical analyses were carried out using procedures available in the Stata 8.0 software package for analysis of complex sample survey data (StataCorp., 2003). Data were weighted to account for colleges' varying sampling fractions. We used contingency tables to present the prevalence estimates of nonmedical use of benzodiazepine anxiolytics in terms of student and college characteristics. Differences among the prevalence of nonmedical use between student and college characteristics were compared using Pearson χ^2 statistics corrected for the survey clustered design. Pearson χ^2 tests were conducted for the following individual-level characteristics (gender, race, Hispanic ethnicity, age, living arrangement, fraternity/sorority membership, grade point average, lifetime sexual behavior, father's level of education, mother's level of education) and college-level characteristics (admissions selectivity, public versus private college, geographical region, commuter status, co-educational status, size of school enrollment, HBCU status, and urban versus rural location). Multiple logistic regressions accounting for the complex design of the sample were used to predict the student level outcomes

of nonmedical use of prescription benzodiazepine anxiolytics, while controlling for the individual-level and college-level characteristics that were significantly associated with either lifetime, past year or past month nonmedical use of prescription benzodiazepine anxiolytics according to the bivariate results ($p < 0.01$). Therefore, odds ratios were adjusted for sex, race/ethnicity, age, living arrangement, membership in social fraternities or sororities, grade point average, sexual behavior, geographical region of college and HBCU status, and 95% confidence intervals (CI) were reported for the odds ratios. Gender interactions were examined in the logistic regression models in order to investigate whether the correlates of nonmedical use of prescription benzodiazepine anxiolytics varied by gender. A similar multivariate approach was used to examine the relationship of nonmedical use of prescription benzodiazepine anxiolytics with the likelihood of engaging in various substance use behaviors, adjusting for other factors. We used Stata to obtain correct standard errors of the estimated regression coefficients accounting for the clustered design of the sample.

3. Results

3.1. Prevalence of nonmedical use

Approximately 7.8% of college students reported lifetime nonmedical use of prescription benzodiazepine anxiolytics, 4.5% reported nonmedical use in the past year, and 1.6% reported nonmedical use in the past month. There was variation across campuses with respect to the past year nonmedical use of prescription benzodiazepine anxiolytics (range 0–20%). There were 11 schools that had an aggregate annual prevalence of 10% or higher and 10 schools had an annual prevalence of 0% while the remaining 98 schools were distributed between these two rates. Based on the overall past year prevalence of 4.5% and an average college sample size of 90, the standard error at the typical/average college was approximately 2%.

As illustrated in Table 1, bivariate analyses indicated that the lifetime, past year and past month prevalence of nonmedical use of prescription benzodiazepine anxiolytics differed significantly as a function of living arrangement, sexual behavior, and geographical location. Most notably, almost one in every three students who had sex partners of both genders reported nonmedical use of benzodiazepine anxiolytics nonmedically in their lifetime. In addition, bivariate analyses indicated that the nonmedical use of prescription benzodiazepine anxiolytics differed significantly as a function of race/ethnicity (lifetime and past year), age (lifetime only), fraternity/sorority membership (past month only), grade point average (past year only), and HBCU status (lifetime and past year).

3.2. Multivariate results

Multivariate logistic regression analyses indicated that past year nonmedical use of prescription benzodiazepine anxiolytics was higher among college students who were White and those students who had been sexually active with both opposite and same sex partners. In addition, nonmedical use of prescription benzodiazepine anxiolytics was less likely to occur among college students who were Asian, Hispanic, attended college in the North Central region of the U.S., and attended a HBCU. After adjusting for other factors, students who had been sexually active with both opposite and same-sex partners were over three times more likely than students who had been sexually active with opposite sex partners only to report nonmedical use of prescription benzodiazepine anxiolytics. Students who attended college in the Southern region of the U.S. were over two times more likely than students attending college in the North Central region to report nonmedical use of benzodiazepine anxiolytics. In fact, the majority of colleges with an annual prevalence of 10% or higher were located in the South and no such colleges were located in the North Central region of the U.S. Finally, HBCU students reported lower levels of nonmedical use; only one HBCU student in the present study (out of 220 HBCU

students in the sample) reported past year nonmedical use of prescription benzodiazepine anxiolytics.

Gender interactions were examined to determine whether there were significant differences in the effects of factors associated with the nonmedical use of prescription benzodiazepine anxiolytics between college men and women. A multivariate approach that included a gender interaction term for each factor from Table 2 was conducted using logistic regression. There were no significant gender interactions in the factors associated with lifetime, past year or past month nonmedical use of prescription benzodiazepine anxiolytics.

3.3. Association between nonmedical use of benzodiazepine anxiolytics and other substance use

As illustrated in Table 3, substance use and other risky behaviors were highly associated with the nonmedical use of prescription benzodiazepine anxiolytics after adjusting for student and college characteristics. For instance, nonmedical benzodiazepine anxiolytic users were over four times more likely than students who had not used benzodiazepine anxiolytics nonmedically to report past month cigarette use and frequent binge drinking in the past 2 weeks. Nonmedical benzodiazepine anxiolytic users were also over 10 times more likely to report past month and past year use of cocaine, ecstasy, and prescription stimulants. In addition, nonmedical users were almost four times more likely to report driving a car after binge drinking and almost six times more likely to report being a passenger with a drunk driver. Most notably, nonmedical benzodiazepine anxiolytic users were over 30 times more likely to report past year nonmedical use of prescription opioid analgesics (OR = 32.13, $p < 0.001$).

At the college-level of analyses, the correlation of nonmedical use of prescription benzodiazepine anxiolytics and substance use at the 119 colleges and universities was examined. The Pearson correlation coefficient between a school's aggregate rate of past year nonmedical use of prescription benzodiazepine anxiolytics and nonmedical use of prescription opioids in the past year was $r = 0.74$ ($p < 0.001$), nonmedical use of prescription stimulants in the past year was $r = 0.48$ ($p < 0.001$), marijuana use in the past year was $r = 0.37$ ($p < 0.001$), and binge drinking in the past 2 weeks was $r = 0.24$ ($p < 0.01$).

4. Discussion

The nonmedical use of prescription benzodiazepine anxiolytics increased significantly among adolescents and college students over the last decade and represents an increasing public health problem in the United States (Johnston et al., 2003a,b; SAMHSA, 2002a). The lifetime, past year and past month prevalence rates of nonmedical use of prescription benzodiazepine anxiolytics in the present study (7.8%, 4.5%, and 1.6%, respectively) were similar to the 2001 MTF sample of college students (9.7%, 5.1%, and 1.5%, respectively) (Johnston et al., 2003a). Many of the student and college characteristics that were significantly associated with nonmedical use of prescription benzodiazepine anxiolytics in the present study have been shown previously to be associated with either increased or decreased risk of alcohol and other drug use among secondary and postsecondary students (e.g., Cashin et al., 1998; Eisenberg and Wechsler, 2003; Gledhill-Hoyt et al., 2000; Johnston et al., 2003a,b; Meilman et al., 1995; Mohler-Kuo et al., 2003; Strote et al., 2002; Wechsler et al., 2002).

The present study found no gender differences in the past year or past month nonmedical use of prescription benzodiazepine anxiolytics among college students, but college men were more likely than college women to report lifetime nonmedical use of benzodiazepine anxiolytics. These gender results were similar to prevalence estimates from the MTF sample of U.S. college students (Johnston et al., 2003a) but varied from past findings showing higher nonmedical use rates among U.S. women (Simoni-Wastila et al., 2004). The results of the present study also

indicated that correlates of nonmedical use of prescription benzodiazepine anxiolytics operated in a similar way for women and men.

In the present study, the higher rates of nonmedical prescription benzodiazepine anxiolytic use found among White college students as compared to African American college students paralleled racial differences found in nonmedical use among U.S. high school seniors (Johnston et al., 2003b) and the racial differences found in prescription rates for benzodiazepine anxiolytics (Simoni-Wastila, 2000). Finally, the lower nonmedical prescription benzodiazepine anxiolytic use at historically black colleges and universities found in the present study was consistent with past research that showed lower rates of alcohol and other drug use at HBCUs relative to non-HBCUs (Meilman et al., 1995).

The higher rates of nonmedical benzodiazepine anxiolytic use found among students who were sexually active with both gender sex partners in the present study are in line with past research that has found higher rates of binge drinking, cigarette smoking and marijuana use among college women who had both gender sex partners relative to those with exclusively opposite-sex partners (Eisenberg and Wechsler, 2003). Furthermore, there was no increased risk among those students who were sexually active with same-sex partners which is consistent with previous work that has found no differences in alcohol and other drug use between college students with same-sex partners versus those with opposite sex partners (e.g., Eisenberg and Wechsler, 2003). The increased risk of substance use among “behaviorally bisexual” students may be related to an underlying personality characteristic such as sensation-seeking that has been linked to alcohol and other drug use among adolescents and college students (e.g., Martin et al., 1992; Read et al., 2003; Wills et al., 1998). Alternatively, it is possible that the increased risk among “behaviorally bisexual” students could be the result of a form of self-medication in response to the stresses associated with this sexual orientation. Based on the heightened risk for AOD use among “behaviorally bisexual” students, more work is needed to further examine the relationship between sexual behavior and substance use.

The regional differences found in the present study are consistent with the differences observed in other national studies among U.S. adolescents and young adults (Johnston et al., 2003a,b). In particular, students who attended school in the Southern region have the highest rates of nonmedical benzodiazepine anxiolytic use. In fact, the present study found that the majority of colleges with an annual nonmedical benzodiazepine anxiolytic prevalence rate of 10% or higher were located in the South. The environmental characteristics that were found to be significantly associated with nonmedical use of prescription benzodiazepine anxiolytics in the present study (e.g., geographical region, HBCU status) have important implications regarding the etiology of benzodiazepine abuse because they point towards “distal” social context factors that need to be considered along with individual characteristics. Future research is needed to examine whether the regional differences observed in the present study are associated with geographic variation found in prescription rates of benzodiazepine anxiolytics in the U.S.

The present study found that nonmedical users of prescription benzodiazepine anxiolytics were significantly more likely to use other drugs and engage in other risky behaviors. Most notably, at both the individual and college levels, the prevalence of nonmedical benzodiazepine anxiolytic use co-occurred to a high degree with the nonmedical use of prescription opiates. For example, 65.7% of nonmedical benzodiazepine anxiolytic users also used prescription opiate analgesics nonmedically in the past year as compared to only 4.4% of students who did not use benzodiazepine anxiolytics nonmedically. In addition, the relationship between a school’s aggregate rate of past year nonmedical use of prescription benzodiazepine anxiolytics and nonmedical use of prescription opiates in the past year ($r = 0.74$, $p < 0.001$) was considerably stronger than the correlation between a school’s aggregate rate of past year nonmedical benzodiazepine anxiolytic use and other alcohol and drug use behaviors. Overall,

the higher rates of substance use and other risky behaviors found among nonmedical benzodiazepine anxiolytic users provides evidence that this form of drug use is likely part of a larger cluster of problem behaviors (Jessor et al., 1991). The pattern of polydrug use among nonmedical benzodiazepine anxiolytic users found in the present study is consistent with previous findings showing the nonmedical use of benzodiazepine anxiolytics occurs largely among people who use other drugs (Woods and Winger, 1995).

4.1. Limitations

Several limitations need to be considered when evaluating the study's findings. First, the present study was subject to the limitations of self-report surveys. However, such surveys have been widely used and are considered generally valid in examining substance use when certain conditions of confidentiality are met (Harrell, 1997; Johnston and O'Malley, 1985; O'Malley et al., 1983; O'Malley and Johnston, 2002). For instance, it was made clear to students in the present study that participation was voluntary, the relevance of the study was explained, and respondents were assured that their responses would remain anonymous. Second, non-response may have introduced potential bias in the present study. While we can never fully eliminate the possibility of bias introduced through non-response, we tried to minimize the impact through weighting procedures such that the demographic distribution of the sample was equivalent to the total student population. In addition, we examined the impact of the response rate and found no significant relationship between response rate and the rate of nonmedical use of benzodiazepine anxiolytics. Finally, the rates of nonmedical use of prescription benzodiazepine anxiolytics reported in this study mirrored national results of college students in 2001 (Johnston et al., 2003a). Third, because the sample consisted of current full-time students attending 4-year U.S. colleges and universities, the sample is not necessarily representative of U.S. young adults not attending 4-year colleges and even less representative of overall U.S. and international populations. Future work is needed to examine whether the findings from this study generalize to other U.S. and international populations. Fourth, the sample sizes for some individual colleges were limited and three of the 119 schools had a sample size less than 50, meaning that a small number of students are being weighted to represent the school's student population. Therefore, colleges and universities are encouraged to collect data from their own campuses to find out more about the prevalence and correlates associated with drug use, including nonmedical use of benzodiazepines. Fifth, the present study likely underestimates the extent of overall nonmedical benzodiazepine use on U.S. college campuses because we focused exclusively on benzodiazepine anxiolytics (e.g., Ativan, Xanax, Valium, Klonopin and Librium) and did not examine the nonmedical use of benzodiazepine hypnotics (e.g., Halcion and Restoril) used largely to treat sleep disorders. As the data were cross-sectional, inferences about causality were limited and we could not assess whether certain risk factors preceded initiation of nonmedical use. Study limitations also included the absence of individual characteristics (e.g., diagnostic information, substance use history) that have been shown to be associated with nonmedical use of prescription benzodiazepine anxiolytics (Griffiths and Weerts, 1997) because such information was not collected. Longitudinal research is needed to further examine the direction of these causal relationships and explore a wider range of variables including individual characteristics, social influences and environmental factors. Such work could serve to move the field beyond the prediction of drug use from other drug use and basic demographics and toward more refined etiologic models which could inform preventative interventions. Finally, future research should consider whether existing theories explaining adolescent substance use can be applied to better understand the nonmedical use of prescription benzodiazepine anxiolytics among adolescents and young adults (e.g., Hawkins et al., 1992; Jessor et al., 1991; Petraitis et al., 1995).

4.2. Implications for future practice and research

The findings of the present study have several important implications for future practice and research. Physicians should instruct all patients who require benzodiazepine anxiolytics about the abuse potential of these medications and the risk associated with taking these drugs nonmedically. Furthermore, based on the high co-occurrence of nonmedical prescription benzodiazepine anxiolytic use with other drugs, college students may experience negative consequences as a result of drug interactions. There have been clinical observations suggesting that benzodiazepines are usually abused in combination with other drugs (Sellers et al., 1993). The concomitant misuse of buprenorphine and benzodiazepines has resulted in at least six deaths among drug abusers and more than half of these cases involved young adults between the ages of 18–20 years (Reynaud et al., 1998). Additionally, drug abuse related emergency department visits involving benzodiazepines increased significantly over the past seven years and currently almost eight out of every 10 benzodiazepine-related ED visits involve two or more drugs (SAMHSA, 2004). Collectively, these findings suggest that future preventative efforts should educate college students regarding the dangerous drug interactions between prescription benzodiazepine anxiolytics and alcohol and other drugs.

Given the findings of higher rates of nonmedical use among college students who have been sexually active with both gender sex partners, college counselors and administrators must be aware that these students may need support services that are sensitive and nonjudgmental. Staff members who work in college health services need to be educated about potentially heightened risk for substance use among these students. Health histories should include questions that assess sexual and substance use behaviors. Finally, many national substance use studies have been limited by a lack of questions about sexual behavior and future studies are encouraged to include such questions.

The nonmedical use of prescription benzodiazepine anxiolytics is apparent among adolescents before they attend college. Approximately one in every three high school seniors reported it would be “fairly easy or very easy” to get prescription tranquilizers for nonmedical use if they wanted some (Johnston et al., 2003b). In 2003, 6.7% of high school seniors reported past year use of tranquilizers and the two most commonly nonmedically used prescription benzodiazepine anxiolytics among U.S. high school seniors were Valium and Xanax (Johnston et al., 2004). Based on the nonmedical use and apparent availability of these drugs among secondary school students, prevention efforts to reduce prescription drug abuse should begin prior to college.

The present study did not assess medically prescribed use of prescription benzodiazepine anxiolytics so it was not possible to assess how many students with legitimate prescriptions for benzodiazepine anxiolytics may have misused their own or someone else’s medication. Future research should be conducted to better characterize nonmedical users and examine how prescription drugs are diverted to nonmedical use among college students. The present investigation did not examine the DSM-IV abuse/dependence of benzodiazepines, quantity of prescription anxiolytics that students were using nonmedically on each occasion, reasons for nonmedical use, route of administration or if these students were using prescription benzodiazepine anxiolytics simultaneously with alcohol and other drugs. Future work examining these areas will help to clarify why, how, and to what extent college students are actually non-medically using prescription benzodiazepine anxiolytics. Finally, there is also recent evidence of nonmedical use of other prescription drugs among adolescents and young adults such as opioid analgesics for pain, stimulant medications for ADHD, and sleeping medications that should be the focus of additional research (Johnston et al., 2003a,b; SAMHSA, 2002a; Zacny et al., 2003).

Considering the recent increases in the nonmedical use of prescription benzodiazepine anxiolytics among college students, it is imperative to continue monitoring this drug use behavior over time and to develop and evaluate prevention programs aimed at reducing prescription drug abuse. There is a clear need to balance medical necessity of benzodiazepine anxiolytics and the risk of nonmedical use and abuse of these drugs (Simoni-Wastila and Tompkins, 2001). Longitudinal research is necessary to examine the relationship between nonmedical use of prescription benzodiazepine anxiolytics and development of substance use disorders (Zacny et al., 2003). Despite the high prevalence and recent increases in nonmedical use, prescription benzodiazepines remain a highly effective and safe medication for the majority of patients (Woods and Winger, 1995). However, findings from the present study provide strong support for the hypothesis that the nonmedical use of prescription benzodiazepine anxiolytics represents a problem among certain segments of the college student population that needs to be deterred with effective prevention efforts and therapeutic strategies while not hindering effective clinical treatment of anxiety disorders and panic attacks.

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Table 1

Nonmedical use of prescription benzodiazepine anxiolytics by student and college characteristics, 2001

Characteristics	Sample (*n*)	Lifetime use % (95% CI)	Past year use % (95% CI)	Past month use % (95% CI)
Race		***	**	NS
White	8198	8.8 (7.8, 9.9)	5.0 (4.3, 5.8)	
African American	790	3.6 (2.2, 6.1)	2.3 (1.2, 4.6)	
Asian	834	3.6 (2.4, 5.2)	2.5 (1.6, 3.9)	
Other	941	6.6 (4.9, 8.8)	4.1 (2.7, 6.2)	
Hispanic		***	**	NS
Non-hispanic	9951	8.1 (7.2, 9.1)	4.7 (4.0, 5.4)	
Hispanic	830	3.9 (2.7, 5.7)	2.2 (1.4, 3.5)	
Age		***	NS	NS
Under 21	5447	6.4 (5.5, 7.4)		
21–23	3958	7.8 (6.6, 9.2)		
24 or older	1438	14.0 (11.9, 16.4)		
Living arrangement		***	**	***
Single-sex residence hall	1297	4.9 (3.5, 6.9)	3.6 (2.4, 5.4)	0.7 (0.3, 1.6)
Co-ed residence hall	2547	5.2 (4.2, 6.5)	3.5 (2.6, 4.6)	1.2 (0.8, 1.8)
Other university housing	399	4.7 (2.7, 8.1)	3.0 (1.6, 5.6)	1.2 (0.4, 3.0)
Fraternity/sorority house	267	11.0 (7.4, 16.0)	7.8 (4.9, 12.3)	4.5 (2.3, 8.6)
Off campus house/other	6251	9.4 (8.3, 10.6)	5.0 (4.2, 5.9)	1.8 (1.4, 2.3)
Fraternity/sorority membership		NS	NS	***
Non-member	9403			1.4 (1.1, 1.8)
Member	1332			2.8 (1.9, 4.2)
Grade point average		NS	**	NS
B or lower	4669		5.2 (4.4, 6.1)	
B+ or higher	6180		3.9 (3.2, 4.7)	
Sexual behavior		***	***	***
Opposite sex partner(s)	7011	9.5 (8.5, 10.6)	5.4 (4.7, 6.3)	1.9 (1.5, 2.4)
Not sexually active	3138	1.8 (1.3, 2.5)	1.1 (0.7, 1.6)	0.3 (0.2, 0.7)
Same sex partner(s)	301	9.3 (6.3, 13.7)	5.9 (3.7, 9.3)	2.6 (1.3, 5.4)
Both sex partners	337	29.7 (23.7, 36.6)	16.8 (12.3, 22.6)	6.2 (3.3, 11.1)
Geographical region		**	**	**
North Central	3210	5.7 (4.7, 6.9)	2.9 (2.3, 3.6)	0.8 (0.5, 1.3)
South	3163	9.5 (7.8, 11.6)	5.8 (4.5, 7.4)	2.3 (1.6, 3.3)
Northeast	2545	8.1 (6.9, 9.6)	5.2 (4.1, 6.5)	1.5 (1.1, 2.0)
West	1931	7.9 (5.9, 10.5)	4.2 (3.0, 6.1)	1.9 (1.2, 2.9)
Historically black college status		***	***	NS
Non-HBCU	10628	7.9 (7.1, 8.8)	4.6 (3.9, 5.3)	
HBCU	220	1.2 (0.6, 2.5)	0.4 (0.1, 2.2)	

NS = non-significant.

** $p < 0.01$,

*** $p < 0.001$: p-values indicate whether distributions are significantly different by student and college characteristics. The results for variables that were not significantly associated with nonmedical use of prescription anxiolytics were not shown ($p < 0.01$).

Table 2

Correlates of nonmedical use of prescription benzodiazepine anxiolytics by student and college characteristics[a]

Characteristics	Lifetime use adjusted OR[b] (95% CI)	Past year use adjusted OR[b] (95% CI)	Past month use adjusted OR[b] (95% CI)
Sex			
Female	*c*	NS	NS
Male	1.28 (1.08, 1.53)**		
Race			
White	*c*	NS	*c*
African American	0.39 (0.23, 0.67)**		0.19 (0.07, 0.57)**
Asian	0.46 (0.29, 0.70)**		0.56 (0.19, 1.66)
Other	1.00 (0.70, 1.41)		1.12 (0.57, 2.21)
Hispanic status			
Non-hispanic	*c*	*c*	NS
Hispanic	0.34 (0.21, 0.56)***	0.31 (0.17, 0.56)***	
Age			
Under 21	*c*	NS	NS
21–23	0.91 (0.75, 1.10)		
24 or older	1.57 (1.21, 2.02)**		
Sexual behavior			
Opposite sex partner(s)	*c*	*c*	*c*
Not sexually active	0.19 (0.14, 0.27)***	0.20 (0.13, 0.30)***	0.20 (0.10, 0.41)***
Same sex partner(s)	1.02 (0.64, 1.63)	1.19 (0.69, 2.04)	1.52 (0.67, 3.46)
Both sex partners	4.16 (3.02, 5.71)***	3.78 (2.66, 5.36)***	3.69 (2.00, 6.81)***
Geographical region			
North Central	*c*	*c*	*c*
South	2.07 (1.55, 2.77)***	2.33 (1.62, 3.35)***	3.36 (1.85, 6.10)***
Northeast	1.78 (1.37, 2.33)***	2.00 (1.41, 2.83)***	2.09 (1.18, 3.72)*
West	1.61 (1.12, 2.32)*	1.74 (1.12, 2.69)*	2.83 (1.41, 5.69)**
Historically black college			
Non-HBCU	*c*	*c*	NS
HBCU	0.17 (0.09, 0.33)***	0.08 (0.01, 0.51)**	

NS = non-significant.

** $p < 0.01$.

*** $p < 0.001$.

[a] The sample sizes for the lifetime, past year and past month models were 10,543 cases.

[b] Odds ratios are adjusted for all predictors in models, which included sex, race, Hispanic ethnicity, living arrangement, age, fraternity/sorority membership, sexual behavior, grade point average, geographical region and historically black college and university status. The results for variables that were not significantly associated with predicting either past year or past month nonmedical use of prescription stimulants were not shown ($p < 0.01$). The design effect ranged from 0.7 to 2.1 for coefficients in the past year logistic regression model, with only one design effect below 1.0.

[c] Reference category.

Table 3

Substance use behaviors associated with nonmedical use of prescription benzodiazepine anxiolytics

Substance use behaviors	Past year nonmedical use (n = 484) unadjusted (%)	No past year nonmedical use (n = 10,251) unadjusted (%)	Adjusted OR (95% CI)[a]
Tobacco and alcohol use			
Cigarette use in the past 30 days	65.3%	23.5%	4.57 (3.54, 5.91)***
Frequent binge drinking in past 2 weeks	57.2	21.1	4.10 (3.24, 5.20)***
Illicit use of drugs in the past 30 days			
Marijuana	62.3	14.7	7.56 (6.04, 9.46)***
Cocaine	16.9	0.8	15.04 (10.12, 22.36)***
Ecstasy	16.4	1.4	10.45 (7.44, 14.70)***
Prescription stimulants	20.1	1.3	14.28 (9.40, 21.69)***
Prescription opioid analgesics	29.3	1.6	18.27 (13.09, 25.52)***
Illicit use of drugs in the past year			
Marijuana	83.2	27.2	11.02 (8.19, 14.83)***
Cocaine	32.3	2.3	14.20 (10.52, 19.27)***
Ecstasy	52.0	5.0	16.23 (12.52, 21.04)***
Prescription stimulants	34.3	2.7	14.36 (10.65, 19.35)***
Prescription opioid analgesics	65.7	4.4	32.13 (25.36, 40.69)***
Other risky behaviors in the past 30 days			
Drove after binge drinking	32.1	9.5	3.74 (2.93, 4.79)***
Passenger with a drunk driver	64.9	21.3	5.81 (4.64, 7.28)***
Drove after drinking alcohol	56.9	26.9	2.88 (2.30, 3.62)***

*** $p < .001$.

[a] The reference group for each model was students who did not report nonmedical use of benzodiazepine anxiolytics in the past year. Odds ratios were adjusted for sex, race, Hispanic ethnicity, age, living arrangement, fraternity/sorority membership, grade point average, sexual behavior, geographical region, and historically black college and university status. The results for these variables were not shown. Unadjusted prevalence estimates for the overall sample were as follows: 30-day cigarette use (25.4%), 2-week frequent binge drinking (22.8%), 30-day marijuana use (16.8%), 30-day cocaine use (1.6%), 30-day ecstasy use (2.1%), 30-day prescription stimulant use (2.1%), 30-day prescription opioid use (2.8%), past year marijuana use (29.7%), past year ecstasy use (7.1%), past year prescription stimulant use (4.1%), past year cocaine use (3.6%), past year prescription opioid use (7.1%), past year drove after binge drinking (10.5%), past year passenger with a drunk driver (23.2%), and past year drove after drinking alcohol (28.2%).