Published in final edited form as:
Drug Alcohol Depend. 2009 June 1; 102(1-3): 63–70. doi:10.1016/j.drugalcdep.2009.01.007.

Subtypes of nonmedical prescription drug misuse

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Abstract

This study used three characteristics (i.e., motive, route of administration, and co-ingestion with alcohol) of nonmedical prescription drug misuse across four separate classes (i.e., pain, sedative/anxiety, sleeping and stimulant medications) to examine subtypes and drug related problems. A Web survey was self-administered by a randomly selected sample of 3,639 undergraduate students attending a large Midwestern 4-year U.S. university. Self-treatment subtypes were characterized by motives consistent with the prescription drug's pharmaceutical main indication, oral only routes of administration, and no co-ingestion with alcohol. Recreational subtypes were characterized by recreational motives, oral or non-oral routes, and co-ingestion. Mixed subtypes consisted of other combinations of motives, routes, and co-ingestion. Among those who reported nonmedical prescription drug misuse, approximately 13% were classified into the recreational subtype, while 39% were in the self-treatment subtype, and 48% were in the mixed subtype. There were significant differences in the subtypes in terms of gender, race and prescription drug class. Approximately 50% of those in subtypes other than self-treatment screened positive for drug abuse. The odds of substance use and abuse were generally lower among self-treatment subtypes than other subtypes. The findings indicate subtypes should be considered when examining nonmedical prescription drug misuse, especially for pain medication.

Keywords

Prescription drug misuse; Motivation; Route of Administration; Co-ingestion; Drug abuse; Nonmedical use; Self-treatment

1. Introduction

Nonmedical prescription drug misuse has increased significantly over the past decade in the United States (Blanco et al., 2007; Johnston et al., 2007; McCabe et al., 2007a; SAMHSA, 2007). The three largest national epidemiological studies of nonmedical prescription drug

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misuse are the *National Survey on Drug Use and Health* (NSDUH), *Monitoring the Future* (MTF), and *National Epidemiologic Survey on Alcohol and Related Conditions* (NESARC). Collectively, these three studies reveal that nonmedical prescription drug misuse is most prevalent among young adults 18 to 25 years old (Kroutil et al., 2006; McCabe et al., 2006a; SAMHSA, 2006, 2007), including surprisingly high rates among college students (Herman-Stahl et al., 2007; Johnston et al., 2007; McCabe et al., 2007a; SAMHSA, 2005).

Despite the increase in the prevalence of nonmedical prescription drug misuse, considerable gaps in knowledge remain regarding heterogeneity and adverse consequences associated with nonmedical prescription drug misuse due to limitations in measurement. For example, prevalence rates from the three above-mentioned studies fail to distinguish between subtypes of individuals who report nonmedical prescription drug misuse to self-treat medical conditions (e.g., prescription pain medication to relieve pain) and those who report nonmedical prescription drug misuse for recreational purposes (e.g., co-ingest prescription pain medication with alcohol to get high). Previous studies suggest many important characteristics associated with nonmedical prescription drug misuse that influence drug abuse potential including motives, routes of administration, and co-ingestion with other drugs (Boyd et al., 2006; Compton & Volkow, 2006a, 2006b; Lankenau et al., 2007; McCabe et al., 2006b, 2007b; McCabe & Teter, 2007; Teter et al., 2005, 2006; Volkow & Swanson, 2003; White et al., 2006). Within the context of nonmedical prescription drug misuse, self-treatment is motivated by the desire to alleviate symptoms consistent with the prescription drug's pharmaceutical main indication and does not involve co-ingestion with alcohol or other drugs or non-therapeutic routes of administration (Boyd & McCabe, 2008).

Increasingly, researchers recognize that motives and other characteristics associated with nonmedical prescription drug misuse are crucial to identify meaningful subtypes (Boyd et al., 2006; Compton & Volkow, 2006; McCabe et al., 2007b; Zacny & Lichtor, 2008). Just as research on motives and other characteristics have helped to identify subtypes of drinking behaviors (Cooper, 1994; Cooper et al., 1995; Schulenberg et al., 1996), marijuana use (Schulenberg et al., 2005; Simons et al., 1998; Zvolensky et al., 2007), and cocaine use (Weiss & Mirin, 1986), an improved understanding of nonmedical prescription drug misuse will help identify subtypes of individuals at greatest risk for adverse consequences. Previous research suggests self-treatment motivates a substantial portion of nonmedical prescription drug misuse while recreational use also motivates a considerable portion of adolescents and young adults (Babcock & Byrne, 2000; Barrett et al., 2005; Boyd et al., 2006; Carroll et al., 2006; Johnston & O'Malley, 1986; McCabe et al., 2007; Rabiner et al., in press; Teter et al., 2005, 2006; White et al., 2006). In order to fully comprehend the risks associated with nonmedical prescription drug misuse, it is necessary to understand the motives because those who engage in self-treatment may face different consequences than those who misuse for recreational purposes.

While previous studies have considered individual characteristics associated with nonmedical prescription drug misuse (e.g., motives, route of administration, and co-ingestion with other drugs), these characteristics have not been considered simultaneously in an attempt to examine subtypes of prescription drug misuse. Identifying different subtypes and related drug problems can help detect individuals at higher risk for developing substance use disorders and distinguish those who may need appropriate treatment for other health conditions and disorders (e.g., pain, ADHD, anxiety, sleep), which is critical for informing clinical practice and designing effective prevention efforts.

Based on previous studies, we hypothesize self-treatment subtypes for nonmedical prescription drug misuse will be associated with less substance use and fewer substance related problems than recreational and other subtypes. The objectives of the present study are to 1) utilize multiple characteristics of nonmedical prescription drug misuse simultaneously across four

separate classes (i.e., pain, sedative/anxiety, sleeping and stimulant medications) to examine three possible subtypes of nonmedical prescription drug misuse (self-treatment, recreational, and mixed); 2) assess the association between the subtypes of nonmedical prescription drug misuse and drug related problems.

2. Methods

2.1 Study design

The present study was conducted in 2005, drawing on a total undergraduate population of over 20,000 undergraduate students attending a large public research university located in the U.S. After receiving Institutional Review Board approval and a Certificate of Confidentiality, a simple random sample of 5,389 undergraduate students was drawn from the total undergraduate population. The entire sample was mailed a pre-notification letter with $2 enclosed describing the study and inviting students to self-administer a Web survey by using a URL address and unique password. Informed consent was obtained online from each participant. Non-respondents were sent up to three reminder e-mails. The Web survey was maintained on an Internet site running under the secure socket layer protocol to ensure privacy and security. By participating in the survey, students became eligible for a sweepstakes that included cash and other prizes. The final response rate was 68% and the completion rate was 97%.

2.2 Sample

The final sample consisted of 3,639 undergraduate students (53.6% women and 46.4% men). The demographic characteristics of the sample closely resembled the overall student population at this university. The mean age of students in the sample was 19.9 years old (SD = 2.0). The racial/ethnic distribution of the sample was 67.4% White, 12.1% Asian, 6.0% African American, 4.5% Hispanic and 10.2% from other ethnic categories. The sample was made up of 28.5% freshmen, 23.4% sophomores, 23.1% juniors and 25.0% seniors.

2.3 Measures

Nonmedical prescription drug misuse was assessed with the following question: “On how many occasions in (a) your lifetime or (b) the past 12 months have you used the following types of drugs, not prescribed to you?” There were separate questions for each of the following four classes of prescription drugs: (a) Pain medication (i.e., opioids such as Vicodin®, OxyContin®, Tylenol 3® with codeine, Percocet®, Darvocet®, morphine, hydrocodone, oxycodone); (b) Stimulant medication (e.g., Ritalin®, Dexedrine®, Adderall®, Concerta®, methlyphenidate); (c) Sleeping medication (e.g., Ambien®, Halcion®, Restoril®, temazepam, triazolam); and (d) Sedative/anxiety medication (e.g., Ativan®, Xanax®, Valium®, Klonopin®, diazepam, lorazepam). The response scale for each prescription drug class was (1) No occasions, (2) 1-2 occasions, (3) 3-5 occasions, (4) 6-9 occasions, (5) 10-19 occasions, (6) 20-39 occasions, and (7) 40 or more occasions.

Motivations for prescription drug misuse were assessed by asking respondents to provide the reasons why they used each class of prescription drugs nonmedically. Respondents who reported nonmedical prescription drug misuse were asked to select all that apply from a list of motives based on previous research (e.g., Johnston & O'Malley, 1986; McCabe et al., 2005c; Teter et al., 2005). Five motivations were listed for all four prescription drug classes: because it gives me a high, because it counteracts the effects of other drugs, because of experimentation, because it's safer than street drugs, and because I'm addicted. In addition, for the sleeping, sedative/anxiety, and pain medication classes, two other motivations were provided: because it helps me sleep and because it helps decrease anxiety. For the stimulant medication class, four additional motivations were included: because it helps me concentrate, because it helps

increase my alertness, because it helps me study, and because it helps me lose weight. For the pain medication class, the motivation “because it relieves pain” was also provided.

Using a variable-centered approach, if respondents only endorsed the motivation that is most consistent with the drug's pharmaceutical main indication (i.e., nonmedical misuse of sleeping medication to sleep, nonmedical misuse of sedative/anxiety medication to decrease anxiety, nonmedical misuse of pain medication to relieve pain, and nonmedical misuse of stimulant medication to help concentrate or increase alertness), they were characterized as demonstrating *self-treatment* motivations. In addition, respondents were considered engaging in *self-treatment* motivations if they also endorsed the main indication and an additional motivation (s) that is related with the drug's pharmaceutical indication (e.g., nonmedical misuse of sleeping medication to help sleep and decrease anxiety, nonmedical misuse of sedative/anxiety medication to decrease anxiety and help sleep, nonmedical misuse of pain medication to relieve pain and help sleep, and nonmedical misuse of stimulant medication to help concentrate and help study). If respondents only endorsed motivations consistent with recreational misuse, they were characterized as engaging in *recreational* motivations (i.e., because it gives me a high, because it counteracts the effects of other drugs, because of experimentation, because it's safer than street drugs, and because I'm addicted). Finally, if respondents endorsed combinations of self-treatment and recreational motives they were considered having *mixed* motivations.

Co-ingestion of prescription drugs and alcohol was assessed with the following question: “In the past 12 months how many days have you used prescription pain medication (i.e., opioids such as Vicodin®, OxyContin®, Tylenol® 3 with codeine, Percocet®, Darvocet®, morphine, hydrocodone, oxycodone), not prescribed to you by a doctor at the same time you were drinking alcohol?” Respondents were asked to enter the number of days in a text box. The same question was asked for co-ingestion of alcohol and each of the other three prescription drug classes. Binary variables were created for (a) *co-ingestion of each prescription drug class and alcohol* and (b) *no co-ingestion*.

Routes of administration were assessed by asking respondents to report how they used each of the following drug classes: (a) Pain medication (i.e., opioids such as Vicodin®, OxyContin®, Tylenol 3® with codeine, Percocet®, Darvocet®, morphine, hydrocodone, oxycodone) and (b) Stimulant medication (e.g., Ritalin®, Dexedrine®, Adderall®, Concerta®, methylphenidate). Respondents were asked to select all that apply from a list of five routes of administration: orally, snorting, smoking, injecting, and inhaling. Binary variables were created for routes of each prescription drug class consisting of (a) *oral only* and (b) *non-oral routes*.

Using a variable-centered approach, *self-treatment* subtypes were characterized by motives consistent with the drug's pharmaceutical main indication, oral only routes of administration, and no co-ingestion with alcohol. *Recreational* subtypes were characterized by recreational motives only, oral or non-oral routes of administration, and co-ingestion or no co-ingestion with alcohol. *Mixed* subtypes consisted of other combinations of motives, routes of administration routes, and co-ingestion.

Past year use of marijuana and other drugs--including cocaine, LSD, psychedelics other than LSD, heroin, crystal methamphetamine, inhalants and ecstasy--was measured with the following question for each substance: “On how many occasions in the past 12 months have you used the following types of drugs?” The response scale for each substance ranged from (1) no occasions to (7) 40 or more occasions. The use of any of the eight substances in the past year was summed to create an index of past year illicit drug use.

The Drug Abuse Screening Test (DAST-10) is a self-report instrument that can be used in clinical and non-clinical settings to screen for potential abuse and dependence on a wide variety

of substances other than alcohol (Skinner, 1982). Respondents who used drugs other than alcohol in the past 12 months were asked about ten drug use related problems they might have experienced in the past 12 months (e.g., inability to stop using drugs, illegal activities to obtain drugs, blackouts as a result of drug use, medical problems as a result of drug use, withdrawal symptoms, felt bad or guilty about drug use, family complaints about drug use). Based on previous research, if a respondent indicated that they had experienced three or more drug related problems, this was considered a "positive" screening test result, denoting potential drug abuse (Cocco & Carey, 1998; French et al., 2001; Maisto et al., 2000; Skinner, 1982). Previous work indicated cutoff scores of either a three or four for theDAST-10 yielded levels of sensitivity and specificity of 0.74 and 0.86, respectively, using DSM-III-R drug use disorder diagnosis as the criterion (Cocco and Carey, 1998). Maisto et al. (2000) also evaluated the DAST-10 using DSM-IV drug use disorder diagnosis as the criterion and found levels of sensitivity and specificity of 0.70 and 0.80, respectively, when using a cutpoint of three.

Binge drinking was measured using the following single item question: "Over the past two weeks, how many occasions have you had five or more drinks in a row (four or more for women)?" The response scale ranged from (1) none to (6) 10 or more occasions (Wechsler et al., 1995).

The CAGE is a standard four-item brief screening instrument used to identify potential alcohol abuse and dependence (Ewing, 1984; Mayfield et al., 1974). Respondents who used alcohol were asked how many times in the past year they had experienced each of the four items (a) felt that you should cut down your drinking, (b) been annoyed by people criticizing your drinking, (c) felt guilt or remorse after drinking, and (d) had a drink first thing in the morning as an "eye opener". Consistent with previous college-based research, if a respondent indicated that they had experienced two or more of these events, this was considered a "positive" screening test result, denoting potential alcohol abuse (Heck, 1991).

Treatment services for substance use was assessed with the following question: "Have you ever used treatment services for alcohol or other drugs?" The response scale was (1) Yes, (2) No.

2.4 Data analysis

Prevalence rates of nonmedical prescription drug misuse subtypes were derived by dividing the number of respondents reporting each subtype by the total number of respondents. Bivariate associations between demographic characteristics and each subtype were tested using chi-square analyses for categorical outcomes. One-way analyses of variance (ANOVA) were used to assess associations between subtypes and frequency of nonmedical prescription drug misuse. Logistic regression analyses were used to compare drug use outcomes across subtypes after statistically controlling for demographic characteristics (e.g., gender, race, class year and living arrangement). Adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) were reported. All statistical analyses were performed using SPSS 15.0 (SPSS Inc., Chicago, IL, USA).

3. Results

3.1 Prevalence of subtypes of nonmedical prescription drug misuse

The lifetime prevalence of nonmedical prescription drug misuse was approximately 20% for at least one of the four prescription drug classes. Among those who reported any lifetime nonmedical prescription drug misuse, approximately 12.6% were classified into the recreational subtype, while 39.1% were in the self-treatment subtype, and 48.3% were in the mixed subtype. The lifetime prevalence of 3 or more occasions was 60.8% for stimulant

medication, 46.2% for sedative/anxiety medication, 45.0% for pain medication, and 38.6% for sleeping medication. The past-year prevalence of nonmedical prescription drug misuse was approximately 13% for at least one of the four prescription drug classes. Among those who reported any past-year nonmedical prescription drug misuse, approximately 11.5% were classified into the recreational subtype, 30.9% were in the self-treatment subtype, and 57.5% were in the mixed subtype. As illustrated in Table 1, the prevalence of the self-treatment subtype varied as a function of prescription drug class. For example, self-treatment was the most prevalent subtype for lifetime misuse of prescription pain and sleeping medications but the least prevalent for sedative/anxiety medication. Notably, most individuals in subtypes other than self-treatment also reported self-treatment which is reflected by the higher prevalence rates of mixed subtypes than recreational subtypes overall and for each prescription drug class with the exception of sedative-anxiety medication.

Over one-third of respondents reported misuse of multiple categories of prescription drugs. In particular, approximately 64.5% reported misuse of one prescription drug class, 19.3% reported misuse of two prescription drug classes, 11.1% reported misuse of three classes, and 5.0% reported misuse of all four classes. The extent of overlap between subtypes from different prescription drug classes was examined by estimating the percentage of lifetime self-treatment misusers of pain medication (n = 206) who reported: 1) no lifetime nonmedical misuse of stimulant medication (91.7%); 2) self-treatment misuse only of stimulant medication (3.9%); 3) recreational misuse only of stimulant medication (1.0%); 4) mixed misuse of stimulant medication (3.4%). In addition, we examined the percentage of lifetime recreational misusers of pain medication (n = 117) who also reported recreational misuse of sleeping medication (7.8%), sedative/anxiety medication (22.4%), and stimulant medication (14.7%).

The mean frequency of lifetime and past-year nonmedical prescription drug misuse was not significantly lower for self-treatment subtypes than other subtypes in any prescription drug class with the exception of pain medication (lifetime and past-year). Analysis of variance (ANOVA) and post hoc tests showed a significant effect for the nonmedical prescription pain medication misuse subtype, $F(1, 489) = 33.14$, $p < 0.001$, and the mean (SD) lifetime frequency of nonmedical pain medication misuse among those who reported self-treatment 2.4 (0.9) was lower than recreational misuse 3.2 (1.4) and mixed misuse 3.5 (1.5).

As indicated in Table 2, there were notable gender and racial differences in the prevalence of nonmedical prescription drug misuse subtypes. Self-treatment subtypes tended to be more prevalent among women than men with the exception of stimulant medication. In contrast, recreational and mixed subtypes were more prevalent among men than women for prescription pain medication and sedative/anxiety medication. All three subtypes for nonmedical stimulant misuse were more prevalent among men than women. When considering all four prescription drug classes combined, self-treatment was more prevalent among women than men (9.1% vs. 6.0%), while recreational (1.6% vs. 3.5%) and mixed (9.1% vs. 10%) subtypes were less prevalent among women than men ($p < .001$). In general, recreational and mixed subtypes were more prevalent among White and Hispanic students than Asian and Black students. When considering all four prescription drug classes combined, the highest prevalence rates for the recreational subtype were reported by White (3.0%) and Hispanic (2.7%) students while the lowest rates were reported by Black (1.0%) and Asian (0.7%) students. Similarly, the highest rates of the mixed subtype were reported by Hispanic (13.0%) and White (10.6%) students while the lowest rates were reported by Asian (5.7%) and Black (3.3%) students. Finally, self-treatment was most prevalent among Black (12.0%) students followed by White (8.1%) and Hispanic (6.8%) students, and least prevalent among Asian (4.2%) students ($p < .001$).

3.2 Nonmedical prescription drug misuse subtypes and drug use and abuse

Bivariate and multivariate analyses were used to examine the associations between subtypes of nonmedical prescription drug misuse, other drug use, and positive screens for alcohol abuse (based on the CAGE) and drug abuse (based on the DAST-10). Chi-square analysis revealed significant associations between nonmedical prescription drug misuse subtypes, other drug use and positive alcohol and drug abuse screens for each prescription drug class ($p < .001$).

As indicated in Table 3, logistic regression analysis revealed the odds of binge drinking, illicit drug use, positive alcohol and drug abuse screens were significantly greater for recreational and mixed subtypes of any nonmedical prescription drug misuse than the self-treatment subtype. The odds of drug abuse were over nine times greater among recreational and mixed subtypes of nonmedical pain medication misuse than the self-treatment subtype. Furthermore, recreational and mixed subtypes of nonmedical pain medication misuse had greater odds of binge drinking, illicit drug use, and positive alcohol abuse screens than those who reported nonmedical misuse of prescription pain medication for self-treatment. In general, the pattern of greater odds for recreational and mixed subtypes relative to self-treatment was present for sleeping, sedative/anxiety, and stimulant medications but not as consistent as for pain medication. For example, the odds of positive alcohol abuse screens did not differ between subtypes for stimulant, sleeping, and sedative/anxiety medications.

Notably, logistic regression analysis indicated self-treatment subtypes of sleeping, sedative/anxiety, or stimulant medications were generally associated with greater odds of drug use and drug related problems as compared to those who did not report prescription drug misuse; however, this was not true for misusers of pain medications. Further, logistic regression analyses were repeated focusing on more frequent misuse (3 or more occasions) and past-year nonmedical prescription drug misuse subtypes. The results of these analyses were consistent to the results based on lifetime misuse in that the odds of drug use and abuse were significantly greater for recreational and mixed subtypes than self-treatment subtypes. For example, the odds of drug abuse were over five times greater for past-year recreational (AOR = 5.2, 95% CI = 2.4 – 10.9) and past-year mixed (AOR = 5.2, 95% CI = 3.0 – 9.0) subtypes of any nonmedical prescription drug misuse than the past-year self-treatment subtype.

Despite the adverse drug related consequences associated with subtypes other than self-treatment, only 5.7% of those in the recreational subtype and 7.5% of those in the mixed subtype across all four prescription drug classes had ever used treatment services for substance use. More specifically, very few individuals in subtypes other than self-treatment from each class of prescription drugs ever used treatment services for substance use: pain medication (10.3% in the recreational subtype and 6.6% in the mixed subtype), sedative/anxiety medication (4.3% in the recreational subtype and 10.3% in the mixed subtype), sleeping medication (0% in the recreational subtype and 17.0% in the mixed subtype, and stimulant medication (3.5% in the recreational subtype and 10.1% in the mixed subtype).

4. Discussion

The present study found the lifetime and past year prevalence of nonmedical prescription drug misuse was 20% and 13%, respectively, and extended previous knowledge regarding heterogeneity in nonmedical prescription drug misuse. The findings indicated that approximately 13% of those who reported any nonmedical prescription drug misuse were classified in the recreational subtype, while 39% were classified in the self-treatment subtype, and 48% were classified in the mixed subtype based on motive, route of administration, and co-ingestion with alcohol. The prevalence of nonmedical prescription drug misuse among college students nationally is at its highest level in the past 15 years and represents a growing public health concern (McCabe et al., 2007a; Johnston et al., 2007). In 2005, the *Monitoring*

the Future study found the lifetime and past-year prevalence of nonmedical prescription drug misuse among college students was 23% and 15%, respectively (Johnston et al., 2007). However, the measures and prevalence rates of nonmedical prescription drug misuse often reported from national studies do not distinguish between individuals who use prescription drugs for self-treatment and those who use prescription drugs for other purposes such as to get high.

The results of the present study provide evidence that nonmedical prescription drug misuse subtypes were differentially associated with other drug use and drug related problems, especially for prescription pain medication. Notably, the odds of drug use and a positive screen for drug abuse did not differ between nonmedical misusers of pain medication in the self-treatment subtype and those who did not engage in nonmedical pain medication misuse. These results reinforce previous studies that have shown adolescents and young adults who engage in nonmedical pain medication misuse are often motivated by self-treatment and such motivations are differentially associated with other drug related behaviors (e.g., Boyd et al., 2006; McCabe et al., 2007b). In contrast, the odds of a positive screen for drug abuse were significantly greater for nonmedical misusers of prescription stimulant, sedative/anxiety, and sleeping medications who reported self-treatment than those who did not engage in nonmedical prescription drug misuse. Thus, the findings suggest students who engage in nonmedical misuse of prescription stimulant, sedative/anxiety and sleeping medications are at increased risk for drug abuse, regardless of subtype. The present study extended previous work that showed nonmedical misusers of prescription stimulants were at elevated risk for alcohol and other drug use, regardless of motive (Teter et al., 2005). Finally, the different patterns for each prescription drug class demonstrates the importance of considering subtypes for each prescription drug class individually instead of relying solely on results based on all four prescription drug classes combined, which may obscure differences such as those found in this study.

There were notable gender and racial differences in the prevalence of nonmedical prescription drug misuse subtypes. For instance, college women reported higher prevalence rates than men of self-treatment involving prescription pain and sedative/anxiety medications. In contrast, college men reported higher prevalence rates than women of recreational and mixed subtypes associated with nonmedical use of pain, sedative/anxiety, and stimulant medications. Interestingly, Black college students reported the highest prevalence rate of self-treatment associated with pain medication but the lowest prevalence rates of recreational and mixed subtypes for prescription pain, stimulant, and sleeping medications. These results reinforce the importance of examining gender and racial differences in subtypes of nonmedical prescription drug misuse and suggest college women and Blacks could be undertreated for some health conditions and disorders such as pain (Pletcher et al., 2008) which could contribute to higher prevalence rates of nonmedical misuse due to self-treatment.

Future clinical and research efforts should differentiate between subtypes of nonmedical prescription drug misuse because subtypes can be associated with different rates of drug use and drug related problems, especially for pain medication. In particular, approximately 50% or more of those who were classified into subtypes other than self-treatment for each prescription drug class had a positive screen for drug abuse based on the DAST-10 suggesting these subtypes are part of a pattern of “multi-problem” behavior (Biglan et al., 2004; Jessor et al., 1991). The findings of the present study suggest individuals who reported subtypes other than self-treatment appear to need more comprehensive assessment for substance use disorders. Despite elevated rates of drug related problems, less than 8% of students who reported subtypes other than self-treatment had ever used substance abuse treatment services. Although there were generally fewer adverse drug related consequences associated with self-treatment subtypes than other suptypes, it is important to note that there are notable health risks for

individuals who obtain prescription medications from non-physician sources, regardless of subtype. For example, nonmedical misusers of prescription medications do not benefit from clinical assessments and medical follow-ups nor do they receive important medical information that usually accompanies a prescription. In addition, nonmedical misusers are likely unaware of the medication's potential for interaction with other drugs or contraindications. Thus, future clinical and research efforts should attempt to differentiate between subtypes of nonmedical prescription drug misuse because such efforts could help identify individuals in need of treatment for an untreated legitimate health condition and/or those who need a more comprehensive substance abuse assessment.

The present study had some limitations that need to be taken into account while considering the implications of the findings. First, the results of the present study may not generalize to other populations because our sample was drawn from one university. At least one recent national study found the past-year rates of nonmedical prescription drug misuse ranged from 0% to 32% across individual U.S. colleges and universities (McCabe et al., 2007a). Future research should examine subtypes of nonmedical prescription drug misuse in multiple U.S. colleges and universities as well as young adults not attending college to assess whether findings in the present study can be replicated in other populations. Second, the data is subject to the potential bias introduced when collecting substance use behaviors via self-reports surveys. The present study attempted to minimize potential biases associated with self-report surveys by implementing conditions that previous research has shown minimizes biases such as informing potential respondents that participation was voluntary, ensuring potential respondents that data would remain anonymous and explaining the relevance of the study to potential respondents (Johnston & O'Malley, 1985; Harrison & Hughes, 1997; O'Malley & Johnston, 2002). It is worth noting that the prevalence rates of nonmedical prescription drug misuse in the present study were comparable to national studies of U.S. college students (Johnston et al., 2007; McCabe et al., 2007a). Third, the assessment of routes of administration did not include sedative/anxiety medication (e.g., Ativan®, Xanax®, Valium®, Klonopin®, diazepam, lorazepam), and sleeping medication (e.g., Ambien®, Halcion®, Restoril®, temazepam, triazolam). Furthermore, the measures used to assess motives and routes of administration did not specify timeframes. Future research should consider other factors associated with prescription drug abuse and dependence such as dose, frequency, chronicity, and context in more detail when examining nonmedical prescription drug misuse subtypes (Compton & Volkow, 2006). Fourth, although the items used in the present study to assess motivations for nonmedical prescription drug misuse have been used in previous work (Boyd et al., 2006; Johnston & O'Malley, 1986; McCabe et al., 2007; Teter et al., 2005), future research is needed to further validate the motivation items associated with the nonmedical use of each prescription medication class. Finally, while the response rate in the present study (68%) compares favorably with other similar studies of college students such as the MTF study (68%), the CORE study (62%), the College Alcohol Study (52%), and the National College Health Assessment (31%), nonresponse may have introduced bias in the present study. Therefore, the impact of nonresponse bias was assessed by administering a short form of the questionnaire via a brief telephone survey to a randomly selected sample of students who did not respond to the original web survey and found minimal evidence for nonresponse bias. In particular, there were no significant differences in prevalence rates of past-year alcohol use, heavy episodic drinking, 30-day cigarette smoking and other problem health behaviors between respondents who completed the original web survey and respondents to the follow-up phone survey.

The findings of the present study provide evidence of heterogeneity in nonmedical prescription drug misuse and indicate multiple subtypes are subsumed under current measures used in national studies such as MTF, NESARC and NSDUH (Boyd et al., 2006; Hubbard et al., 1992; McCabe et al., 2006c, 2007b). Efforts to prevent negative drug related consequences associated with nonmedical prescription drug misuse must be based on knowledge of the

antecedents and patterns associated with this behavior. Although there appear to be different subtypes of nonmedical prescription drug misuse, there is not nearly enough known about these subtypes over time and related adverse consequences. The findings of the present study suggest the importance of moving away from combining multiple subtypes into the same measure of nonmedical prescription drug misuse, especially for prescription pain medication.

Acknowledgments

The development of this manuscript was supported by research grants DA018239 and DA020889 from the National Institute on Drug Abuse, National Institutes of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Drug Abuse or the National Institutes of Health. The authors would like to thank James A. Cranford and Brady T. West for their assistance with data analysis. We also thank the anonymous reviewers for their helpful comments on an earlier version of this article.

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Table 1

Frequency distributions of lifetime and past-year nonmedical prescription drug misuse

	Lifetime nonmedical prescription drug misuse status[a]		Past-year nonmedical prescription drug misuse status[b]	
	(n)	(%)	(n)	(%)
All four medication classes				
Nonuse	2837	80.3	3111	87.8
Self-treatment only	272	7.7	134	3.8
Recreational only	88	2.5	50	1.4
Mixed	336	9.5	249	7.0
Pain medication				
Nonuse	3045	86.1	3288	92.8
Self-treatment only	207	5.9	76	2.1
Recreational only	117	3.3	64	1.8
Mixed	166	4.7	116	3.3
Stimulant medication				
Nonuse	3255	91.7	3343	94.1
Self-treatment only	78	2.2	53	1.5
Recreational only	57	1.6	21	0.6
Mixed	160	4.5	135	3.8
Sleeping medication				
Nonuse	3398	95.6	3469	97.6
Self-treatment only	91	2.6	45	1.3
Recreational only	17	0.5	9	0.2
Mixed	47	1.3	33	0.9
Sedative/anxiety medication				
Nonuse	3400	95.8	3463	97.5
Self-treatment only	23	0.6	10	0.3
Recreational only	69	1.9	44	1.2
Mixed	58	1.6	34	1.0

[a]The number of respondents who indicated “rather not say” or were missing responses for lifetime misuse ranged from 86 to 106.

[b]The number of respondents who indicated “rather not say” or were missing responses for past-year misuse ranged from 83 to 95.

Table 2

Gender and racial differences in lifetime prevalence of nonmedical prescription drug misuse subtypes

	Pain medication (n = 3,535)			Stimulant medication (n = 3,550)			Sleeping medication (n = 3,553)			Sedative/anxiety medication (n = 3,550)		
	Self-treatment	Recreational	Mixed	Self-treatment	Recreational	Mixed	Self-treatment	Recreational	Mixed	Self-treatment	Recreational	Mixed
	%	%	%	%	%	%	%	%	%	%	%	%
Gender	***	***	***	***	***	***				*	*	*
Female	7.2	2.6	4.3	2.0	0.8	4.3	2.9	0.6	1.3	1.0	1.6	1.5
Male	4.3	4.2	5.1	2.4	2.5	4.8	2.1	0.4	1.4	0.2	2.3	1.8
Race	***	***	***	***	***	***						
Asian	3.1	1.2	2.4	1.2	0.5	3.3	1.6	0.0	0.7	0.2	0.2	0.9
Black	9.6	1.0	1.0	2.4	0.0	0.5	1.9	0.0	0.0	0.5	0.5	1.9
Hispanic	6.2	0.7	6.2	2.7	3.4	6.7	2.7	0.7	2.7	0.0	2.7	0.7
White	6.0	4.2	5.3	2.6	1.9	5.0	2.5	0.6	1.3	0.8	2.4	1.7
Other	5.8	2.2	4.7	0.6	1.4	3.9	4.2	0.3	2.2	0.6	1.7	1.9

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$ based on chi-square tests.

Table 3

Substance use and substance related problems based on lifetime nonmedical prescription drug misuse subtypes

	Binge drinking in the past two weeks		CAGE (+ screen) in the past year[a]		Marijuana and other illicit drug use in the past year[b]		DAST-10 (+ screen) in the past year[c]	
	%	AOR[d] (95% CI)	%	AOR[d] (95% CI)	%	AOR[d] (95% CI)	%	AOR[d] (95% CI)
All four medication classes								
Self-treatment only	51.3	Referent	20.4	Referent	37.5	Referent	9.6	Referent
Recreational only	78.4	3.0 (1.7 – 5.4)***	37.5	2.2 (1.3 – 3.7)**	81.8	6.8 (3.7 – 12.4)***	40.9	5.4 (3.0 – 9.9)***
Mixed	82.4	4.3 (2.9 – 6.3)***	38.8	2.3 (1.6 – 3.4)***	80.8	6.8 (4.6 – 9.8)***	44.9	7.4 (4.6 – 11.8)***
Nonuse	48.9	1.0 (0.7 – 1.2)	17.6	0.9 (0.6 – 1.2)	28.4	0.7 (0.5 – 0.9)**	4.3	0.4 (0.3 – 0.6)***
Pain medication								
Self-treatment only	49.3	Referent	18.0	Referent	35.0	Referent	8.7	Referent
Recreational only	84.6	4.6 (2.6 – 8.3)***	45.3	3.4 (2.0 – 5.8)***	86.3	10.5 (5.7 – 19.3)***	54.7	11.6 (6.2 – 21.8)***
Mixed	82.5	4.6 (2.8 – 7.7)***	36.1	2.4 (1.5 – 4.0)***	80.1	7.3 (4.5 – 11.9)***	47.0	9.1 (5.0 – 16.4)***
Nonuse	50.5	1.1 (0.8 – 1.4)	18.6	1.1 (0.7 – 1.5)	31.0	0.8 (0.6 – 1.1)	5.8	0.6 (0.4 – 1.1)
Stimulant medication								
Self-treatment only	87.0	Referent	39.0	Referent	73.1	Referent	28.2	Referent
Recreational only	77.2	0.5 (0.2 – 1.3)	38.6	1.0 (0.5 – 2.1)	89.5	3.2 (1.2 – 8.5)*	47.4	2.0 (1.0 – 4.3)
Mixed	89.9	1.3 (0.5 – 3.1)	42.1	1.1 (0.6 – 1.9)	90.6	3.9 (1.8 – 8.3)***	57.5	4.0 (2.2 – 7.3)***
Nonuse	50.0	0.2 (0.1 – 0.3)***	18.4	0.4 (0.2 – 0.6)***	31.0	0.2 (0.1 – 0.3)***	6.1	0.2 (0.1 – 0.3)***
Sleeping medication								
Self-treatment only	67.0	Referent	38.5	Referent	55.1	Referent	26.4	Referent
Recreational only	76.5	1.3 (0.4 – 4.4)	35.3	0.8 (0.3 – 2.3)	88.2	5.4 (1.2 – 25.4)*	70.6	6.3 (2.0 – 20.1)**
Mixed	83.0	2.0 (0.8 – 5.0)	40.4	1.0 (0.5 – 2.0)	76.6	2.4 (1.1 – 5.4)*	51.1	2.7 (1.3 – 5.9)**
Nonuse	52.2	0.5 (0.3 – 0.9)**	19.4	0.4 (0.3 – 0.6)***	34.2	0.4 (0.3 – 0.6)***	8.2	0.2 (0.1 0.4)***
Sedative/anxiety medication								
Self-treatment only	60.9	Referent	47.8	Referent	47.8	Referent	26.1	Referent
Recreational only	95.7	12.2 (2.8 – 53.4)**	36.2	0.5 (0.2 – 1.4)	94.2	15.7 (4.2 – 58.9)***	66.7	4.3 (1.4 – 12.7)**
Mixed	77.6	2.3 (0.7 – 6.9)	44.8	0.8 (0.3 – 2.3)	78.9	4.1 (1.4 – 12.0)*	46.6	2.1 (0.7 – 6.3)

	Binge drinking in the past two weeks		CAGE (+ screen) in the past year[a]		Marijuana and other illicit drug use in the past year[b]		DAST-10 (+ screen) in the past year[c]	
	%	AOR[d] (95% CI)	%	AOR[d] (95% CI)	%	AOR[d] (95% CI)	%	AOR[d] (95% CI)
Nonuse	51.7	1.1 (0.9 – 1.3)	19.1	0.3 (0.1 – 0.6)**	33.5	0.5 (0.2 – 1.3)	7.7	0.2 (0.1 – 0.5)**

[a] A cutpoint score of two or more was used for the CAGE.

[b] Marijuana and other illicit drug use consisted of any use of the following: marijuana, cocaine, LSD, other psychedelics, ecstasy, inhalants, heroin or crystal methamphetamines.

[c] A cutpoint score of three or more was used for the DAST-10.

[d] Adjusted odds ratios (AOR) are adjusted for gender, race/ethnicity, class year and living arrangement (odds ratios for these variables are not shown).

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$.