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The Occurrence of Cannabis Use Disorders and other Cannabis-Related Problems among First-Year College Students

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Abstract

This study reports the prevalence of cannabis use disorders (CUD) and other cannabis-related problems in a large cohort ($n=1253$) of first-year college students, 17 to 20 years old, at one large public university in the mid-Atlantic region of the U.S. Interviewers assessed past-year cannabis use, other drug use, and cannabis-related problems (including DSM-IV criteria for CUD). The prevalence of CUD was 9.4%_{wt} among all first-year students and 24.6% among past-year cannabis users ($n=739$). Of those endorsing any CUD criteria, 33.8% could be classified as diagnostic orphans. Among 474 “at-risk” cannabis users (≥ 5 times in the past year), concentration problems (40.1%), driving while high (18.6%) and missing class (13.9%) were among the most prevalent cannabis-related problems, even among those who endorsed no CUD criteria. Placing oneself at risk for physical injury was also commonly reported (24.3%). A significant proportion of cannabis-using college students meet diagnostic criteria for disorder. Even in the absence of disorder, users appear to be at risk for potentially serious cannabis-related problems. Implications for prevention, service delivery, and future research are discussed.

Keywords

Cannabis; marijuana; drug dependency; drug abuse; college students; research diagnostic criteria

1. Introduction

According to the most recent data from *Monitoring the Future*, in 2006 close to one in three (30.2%) college students had used cannabis in the past year (Johnston, O’Malley, Bachman, & Schulenberg, 2007). These prevalence estimates are similar to findings from the 2001 *Harvard College Alcohol Study* (Mohler-Kuo, Lee, & Wechsler, 2003), which reported that 30% of college students used cannabis in the past year. Moreover, as with other forms of illicit drug use, young adults consistently have a higher prevalence of cannabis use than other age groups (Substance Abuse and Mental Health Services Administration [SAMHSA], 2006), and

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college students appear to be no different from their non-college-attending peers in this respect (Johnston, O'Malley, Bachman, & Schulenberg, 2006).

Considering the widespread use of cannabis among college students, it is surprising that epidemiologic data on cannabis use disorders in this subpopulation are scarce. Cannabis use disorders (CUD) encompass the two distinct diagnoses of abuse and dependence, defined in the DSM-IV by the same criteria as for other substance use disorders (American Psychiatric Association [APA], 1994). As compared to other age groups, young adults are known to have the highest past-year prevalence of CUD (5.9%), owing in part to their correspondingly high prevalence of cannabis use (SAMHSA, 2006). To our knowledge, however, no studies have measured CUD prevalence among young adults attending college. Anthony et al. (1994) analyzed data from the *National Comorbidity Survey* and observed a substantially higher lifetime prevalence of cannabis dependence among adolescent and young-adult cannabis users as compared to older users. More recent results from another national epidemiologic study indicate that approximately one in three past-year cannabis users in the general population meets criteria for CUD (Compton, Grant, Colliver, Glantz, & Stinson, 2004), however estimates for college-attending young adults were not reported. As yet, it is unknown whether cannabis-using college students experience a risk for CUD that is similar to other young adults.

Aside from the risk for CUD, an extensive body of literature has described other adverse effects of cannabis use, and while most long-term effects appear to be limited to heavy or chronic use, important short-term effects occur during the acute phase of intoxication, regardless of the frequency of use (see reviews by Budney, Moore, & Vandrey, 2004; Joy, Watson, & Benson, 1999; Kalant, 2004). Neurocognitive impairments—such as problems with psychomotor function, attention, memory, and learning—occur during intoxication, some of which persist after a brief period of abstinence. The possible functional consequences of these effects are an important area of concern, as they have the potential to affect the large number of individuals who use cannabis moderately or occasionally. However, most prior evidence of the adverse effects of cannabis use stems from clinical and experimental studies, whereas epidemiologic data about the proportion of cannabis users who experience specific effects has been limited.

Several prior studies of college students have investigated cannabis-related problems and warrant mention here. In one study, the number of cannabis-related problems significantly increased during the transition from high school to college (White, Labouvie, & Papadaratsakis, 2005), but data on discrete cannabis-related problems were not presented. In another study of alcohol-using college students, use of cannabis significantly increased the risk for experiencing any substance-related problems, even controlling for heavy drinking and demographics (Shillington & Clapp, 2001). Other studies of college students have linked cannabis use to specific health risk behaviors, such as smoking tobacco (Hammersley & Leon, 2006; Tullis, Dupont, Frost-Pineda, & Gold, 2003) and unsafe driving practices (Everett, Lowry, Cohen, & Dellinger, 1999). These studies have had limited generalizability, and none were designed to estimate prevalence or assess CUD. Nevertheless, they demonstrate the public health significance of this issue and draw attention to the need for a more complete understanding of the types of problems associated with cannabis use among college students.

By definition, individuals with CUD experience functional problems in their lives as a result of their cannabis use, such as loss of major role functions and repeated legal problems (APA, 1994). While the DSM-IV criteria are helpful in identifying individuals with the most serious risk for cannabis-related problems, prior evidence suggests that a substantial number of problematic users are overlooked by these definitions (Degenhardt, Lynskey, Coffey, & Patton, 2002). Therefore, more research is warranted to describe the prevalence of cannabis-related problems experienced by cannabis users who fall below the threshold of CUD (i.e., “diagnostic orphans”) and identify how they may differ from CUD cases.

In any study of drug users, it can be difficult to disentangle the consequences of cannabis use from those of other substances, especially in light of the high prevalence of polysubstance use among cannabis users (Gledhill-Hoyt, Lee, Strote, & Wechsler, 2000). Prior evidence suggests that cannabis users are more likely to experience CUD and other cannabis-related problems if they are also heavy drinkers and/or cigarette smokers (Chen, O'Brien, & Anthony, 2005; Degenhardt et al., 2002). Whether this association between CUD and drinking and smoking tobacco holds true for college students is unknown.

The present study attempts to address the gap in the literature on cannabis-related problems among college students. Using data from a large cohort of systematically sampled first-year college students, the present study aims to: 1) estimate the prevalence of CUD; 2) determine the proportion of users who meet criteria for dependence; 3) describe the occurrence of cannabis-related problems among cannabis users; and 4) determine whether CUD cases differ from “diagnostic orphans” and non-problematic cases with respect to cannabis-related problems and intensity of use. Additionally, as a post-hoc analysis, we compared the prevalence of CUD and cannabis-related problems amongst light vs. heavy drinkers and tobacco cigarette smokers vs. non-smokers.

2. Methods

2.1. Study Design

Participants were recruited as part of the College Life Study (Arria et al., In press). Ascertainment of the sample occurred in two stages. First, a brief screening survey was administered to 3401 incoming first-time, first-year students who attended new student orientation at one large, public university in the mid-Atlantic region of the United States during the summer of 2004. The screened sample was representative of students in the first-year class with respect to demographic characteristics, and the response rate was 89%. Next, a stratified random sample of screener participants was selected for a longitudinal study, beginning with a two-hour face-to-face interview administered during their first year of college. Purposive sampling strategies were employed to obtain a disproportionate number of experienced drug users (i.e., individuals who had used cannabis or other illicit drugs at least once in their lives). The interview response rate was 86% ($n=1253$). Additional details of the sampling and recruitment methods are presented elsewhere (Arria et al., In press). Participants received \$5 for participating in the screener and \$50 for completing the interview. Informed consent was obtained for participation in all phases of the study. The study was reviewed and approved by the University Institutional Review Board, and a federal Certificate of Confidentiality was obtained.

The interview methodology was based on the National Survey of Drug Use and Health (NSDUH) and consisted of a structured epidemiologic survey with standardized language and skip patterns. Interviewers read the questions verbatim from the interview booklet and recorded the responses directly into the booklet, as either numerals or forced-choice options, using standard show card aids as needed to illustrate the available response options. Interviews were conducted in research offices and other locations on the university campus. Interviewers were either graduate students, recent graduates, or advanced undergraduates, all of whom were extensively trained on interviewing techniques and maintenance of confidentiality. Interviewers received regular supervision and spot-checks were conducted to monitor data integrity.

2.2. Participants

Data for the present study are from the 1253 participants, aged 17 to 20, who completed a face-to-face interview. Approximately half were female (51.4%), 72.4% were white, and as a proxy

for socioeconomic status, 73.5% indicated their mother had attained a 4-year college degree or more.

2.3. Measures

2.3.1. Illicit drug use—Students were asked about their use of ten illicit substances: cannabis, inhalants, cocaine, hallucinogens, heroin, amphetamines (including methamphetamine), ecstasy, and nonmedical use of three classes of prescription drugs (i.e., analgesics, stimulants, tranquilizers). Separate items captured frequency of lifetime, past-year and past-month use, age of initiation, and recency of use. As a general index of drug involvement, an index summing the total number of illicit drugs (other than cannabis) used in the past year (0–9) was computed.

2.3.2. Cannabis use disorders (CUD) and other cannabis-related problems—Students who had used cannabis five or more times in the past year were assessed for CUD and other cannabis-related problems, using questions based in part on the NSDUH interview (SAMHSA, 2003). To minimize the burden on respondents in this lengthy interview, students who used cannabis less than five times in the past year skipped out of this series, similar to procedures used in the NSDUH. Students who used cannabis five or more times in the past year were asked the full series of questions about CUD and cannabis-related problems, and were therefore considered “at-risk” in the present analyses.

To assess the prevalence of CUD, students were asked about ten problems they might have experienced during the past 12 months as a result of their cannabis use, using questions from the NSDUH. These problems correspond to the DSM-IV criteria for cannabis abuse and dependence. Based on the combination of criteria endorsed, four mutually exclusive categories were defined: dependence, abuse, diagnostic orphans, and non-problematic use (See Table 1). Consistent with the DSM-IV guidelines (APA, 1994), dependence cases were defined by the endorsement of three or more of the following six criteria as a result of their cannabis use: tolerance, using more than intended, being unable to cut down, spending a lot of time obtaining or using, giving up important activities, or continuing to use despite problems with physical or mental health. Abuse cases were defined as non-dependent individuals who endorsed one or more of the following four problems resulting from their cannabis use: having serious problems at home, work, or school; regularly putting oneself in physical danger; repeatedly getting into trouble with the law; or continuing use despite problems with family or friends. Diagnostic orphans were defined as individuals who endorsed one or two dependence criteria and no abuse criteria, and therefore escaped both CUD diagnoses. Finally, non-problematic cases were individuals who endorsed none of the ten DSM-IV criteria for CUD. A similar classification was used by Degenhardt et al. (2002).

In addition, the interview contained questions on six other cannabis-related problems outside the scope of the DSM-IV criteria, listed in Table 2. These items were designed to be specifically relevant for college students (e.g., missing class). As shown in Table 2, the exact wording of each question stipulated that we were only interested in problems that occurred as a result of cannabis use, the one exception being that housing violations due to drug use may have involved illicit drugs other than cannabis. (Further inspection confirmed that in all cases with drug-related housing violations, cannabis was the apparent drug of choice, being used far more frequently than any other illicit drug.) For the present analyses, data on “how often” an event occurred were transformed as “ever” vs. “never,” and frequencies were computed for affirmative responses to each problem.

2.3.3. Past-month use of alcohol and tobacco cigarettes—In two separate questions, students were asked about their recent use of alcohol and tobacco with the following question:

“During the past 30 days, on how many days did you smoke tobacco cigarettes [drink alcohol]?” Responses ranged from 0 to 30. Within the subset of 474 “at-risk” cannabis users, data were examined to identify logical cutpoints to divide the sample into groups as follows. Nearly all (96%) had used alcohol in the past month, with a median of 9 drinking days in the past month, so the sample was divided at the median into 235 infrequent drinkers (0 to 8 drinking days) and 239 frequent drinkers (9 or more drinking days). By contrast, cigarette smoking was much less prevalent in this sample, with a majority (57%, $n=270$) not smoking at all in the past month, and only 12% ($n=55$) smoking 20 or more days in the past month. Therefore, “at-risk” cannabis users were divided into 204 past-month tobacco cigarette smokers (1 or more smoking days) and 270 non-smokers (0 smoking days).

2.4. Statistical analyses

As noted above, experienced substance users were overrepresented in our sample, but because the probability of selection was known, we were able to derive sampling weights to yield a weighted sample size ($N=3219$) that is representative of the entire screened population of first-year students at the university. The sample was stratified on the basis of gender, race (White, African-American/Black, Asian/Pacific Islander, Other), and history of illicit drug use during high school (ever, never), using data collected in the screener survey (Arria et al., In press). Sampling weights were then computed by dividing the number of screened students within each gender-race-drug stratum by the number of sampled students within the corresponding stratum. The weighted overall population prevalence of CUD among the entire first-year class was then derived by applying the sampling weights to the proportion of the sample meeting CUD criteria. Next, unweighted frequencies for the CUD diagnoses and each DSM-IV criterion were computed among the 739 past-year cannabis users who provided complete data. Individuals who used cannabis less than five times in the past year (and therefore were not asked about cannabis-related problems) were automatically coded for the absence of each DSM-IV criterion, which enabled us to retain them in the denominator.

For the analyses pertaining to cannabis-related problems and comparisons between the four groups (diagnostic orphans, non-problematic use, abuse, dependence), the sample was further restricted to the 474 individuals who used cannabis at least five times during the past year (i.e., “at-risk users”) and provided complete data. To determine whether diagnostic orphans differed from other cannabis users, a series of bivariate analyses was performed to test for significant differences between the four groups with respect to the occurrence of six cannabis-related problems and the intensity of cannabis use. The four-level categorical variable (diagnostic orphans, non-problematic use, abuse, dependence) served as the independent variable in a series of log-linear regressions with each binary dependent variable (past-year cannabis-related problems) and a series of linear regressions with each continuous dependent variables (age of initiation, past-year and past-month consumption, number of other illicit drugs used in the past year). Tests that were statistically significant at $p<.05$ were further evaluated for all possible pairwise comparisons amongst the four diagnostic groups, using procedures to control for multiple comparisons. All analyses were conducted using SAS version 9.1.

3. Results

3.1. Prevalence of CUD

Table 1 presents the weighted prevalence estimates of cannabis dependence, cannabis abuse, and each separate DSM-IV criterion among the entire class of first-year students at the university. Almost 10%_{wt} of students met criteria for CUD, with 4.0%_{wt} meeting criteria for abuse and 5.4%_{wt} meeting criteria for dependence. An additional 5.0%_{wt} of students were classified as diagnostic orphans. In sum, 14.4%_{wt} of all students met at least one DSM-IV criterion for CUD.

3.2. Prevalence of CUD and DSM-IV criteria among cannabis-using college students

Also shown in Table 1 is the proportion of past-year cannabis users who met criteria for CUD. One in ten users (10.1%) met the clinical definition for dependence, and 14.5% met the definition for abuse. Together, nearly one in four (24.6%) past-year cannabis users were CUD cases. Combining the CUD cases with the additional 12.6% who were classified as diagnostic orphans yields a total of 37.2% of cannabis users endorsing at least one CUD criterion.

Examining the subset of 474 “at-risk” users (i.e., those who used cannabis at least 5 times in the past year), we found that one in three (32.6%) felt that they had spent “a lot of time” obtaining or using cannabis during the past year. Other prevalent DSM-IV items were developing tolerance to the effects of cannabis (27.0%) and putting oneself in physically dangerous situations while using cannabis (24.3%). By contrast, very few cannabis users experienced repeated legal problems due to cannabis use (2.3%).

The fifth column of Table 1 depicts the subset of individuals who could be considered “regular” cannabis users, using the definition of six or more days of use in the past month (Andersson et al., 2007). Not surprisingly, the majority of these “regular” users met criteria for either abuse (28.6%) or dependence (38.6%). However, legal problems remained rare (4.3%).

3.3. Prevalence of other cannabis-related problems

Table 2 depicts the occurrence of six other cannabis-related problems that are not subsumed under the DSM-IV taxonomy for CUD. Concentration problems (40.1%) and missing class (13.9%) were two of the most prevalent consequences, even among the “non-problematic” individuals who endorsed no DSM-IV criteria (27.1% and 7.0%, respectively). Driving while high was reported by nearly one in five “at-risk” cannabis users (18.6%). By contrast, very few individuals received drug-related housing violations (3.0%).

3.4. Comparison of diagnostic orphans with CUD and non-problematic cases

Table 2 presents the results of the comparisons between diagnostic orphans and the three other mutually exclusive groups of cannabis users (non-problematic use, abuse, and dependence cases) with respect to the six cannabis-related problems (concentration problems, driving high, missing class, problems with either friends or family, housing violations) and four measures of cannabis involvement (age of onset, past-year and past-month frequency of use, number of other drugs used). In general, the results are in the expected direction, with CUD cases having the most problems, non-problematic users having the least problems, and diagnostic orphans falling somewhere in between. Interestingly, diagnostic orphans were significantly different from abuse cases in five out of the ten comparisons, but they were similar to non-problematic cases in nearly all comparisons, with two notable exceptions. Compared with non-problematic cases, diagnostic orphans used a significantly greater number of other illicit drugs in the past year on average (1.0 vs. 0.6), and they were significantly more likely to oversleep and miss class after using cannabis (15.1% vs. 7.0%). Moreover, diagnostic orphans were not significantly different from either non-problematic use or abuse cases with respect to the age of onset and the occurrence of concentration problems. Housing violations were the only cannabis-related problems that did not significantly differ among the groups.

3.5. Cannabis-related problems, alcohol consumption and tobacco smoking

The prevalence of CUD and the six other cannabis-related problems were explored in more detail with respect to the frequency of drinking alcohol and smoking tobacco cigarettes in the past month (see Table 3). As can be seen, in the comparison between 235 infrequent drinkers and 239 frequent drinkers, CUD and cannabis-related problems were similarly prevalent regardless of drinking frequency. Comparing the 270 who never smoked cigarettes in the past

month with the 204 who smoked at least once, significant differences in cannabis-related problems were observed. Notably, cannabis dependence was considerably higher among cigarette-smoking cannabis users than among their non-cigarette-smoking counterparts (22.6% vs. 10.7%, $\chi^2=19.1$, $df=3$, $p=.0003$). Cannabis-related concentration problems (47.1% vs. 34.8%, $\chi^2=7.3$, $df=1$, $p=.007$) and driving while high (24.0% vs. 14.4%, $\chi^2=7.0$, $df=1$, $p=.008$) were also significantly more prevalent among cigarette-smoking cannabis users than non-cigarette-smoking cannabis users.

4. Discussion

4.1. Review of major findings

In this study of first-year college students, nearly one in ten (9.4% wt) individuals met the clinical definition for CUD, while 24.6% of all cannabis-using students met the definition for CUD. Although no comparable data are available for other young college student samples, it is interesting to note the substantial differences between these findings and results from recent national surveys of young adults in the general population. First, the overall prevalence of CUD appears to be considerably higher in our sample (9.4% wt) than in the general population of young adults, estimated at 4.4% of 18-to-29 year-olds (Compton et al., 2004) and 5.9% of 18-to-25 year-olds (SAMHSA, 2006). Conversely, the prevalence of CUD among cannabis users in this study is markedly lower than the estimate of 42.1% reported by Compton et al. (2004) for the general population of cannabis-using young adults.

Whether these differences are attributable to methodological differences or to more substantive characteristics of this cohort or of college students in general is unknown. However, one possible explanation is that the younger age of our sample and certain cultural aspects of college life may account for some of these differences. For example, perhaps young college students have a high rate of experimenting with casual cannabis use, whereas young adults in their middle and late twenties, if they use cannabis at all, are more likely to be habitual users. This notion is supported by prior evidence that college students—although similar to their non-student peers with respect to annual cannabis use—are less likely to use cannabis on a daily basis (Johnston et al., 2006). Furthermore, the college student population underrepresents individuals of lower socioeconomic status, incarcerated persons, and others with elevated risk for substance use disorders who would be included in general population surveys. Future study with this cohort will track the persistence and desistence of CUD over time.

This study extends prior evidence that a large proportion of cannabis users experience problems without meeting the full DSM-IV definitions for abuse or dependence (Degenhardt et al., 2002). In this sample, one-third (93 out of 275, or 33.8%) of individuals who experienced any signs of abuse or dependence failed to meet the case definition for CUD. Furthermore, several other cannabis-related problems were prevalent (e.g., concentration problems, driving while high), regardless of DSM-IV criteria. Interestingly, individuals who could be classified as “diagnostic orphans” were similar to non-problematic cases with respect to age of onset and frequency of use, suggesting that some cannabis-using college students might be at risk for cannabis-related problems even if they do not appear to be heavy users. Future studies with this cohort will observe the course of cannabis involvement over time and the extent to which the patterns of use and related problems intensify and/or dissipate.

4.2. Limitations

Several important limitations of this study should be noted. First, because we did not assess cannabis-related problems among students who used cannabis less than five days in the past year, we cannot determine how our weighted prevalence estimates may have been affected by including these low-frequency users. While it is probable that very few (if any) of these low-

frequency users would have endorsed any of the cannabis-related problems had they been asked, this assumption cannot be verified; therefore prevalence estimates should be regarded as conservative.

Students in this study were asked about a limited number of cannabis-related problems, and therefore it is possible that other problems might have been detected if we had used an open-ended style of questioning. Also, because we did not use a standardized measure of cannabis-related problems, our findings may not be comparable to prior studies (e.g., Black & Casswell, 1992; Simons & Carey, 2002). However, unlike prior studies, our aim was to describe the occurrence of specific problems relevant to a college-student population, rather than to obtain an index for the number of problems.

We cannot discount the possibility of overreporting of CUD criteria by some participants, which warrants consideration in light of prior evidence that adolescent cannabis users tend to overreport certain clinical features of dependence (Chen & Anthony, 2003). Moreover, the validity of the DSM-IV criteria for adolescent and young adult populations has been called into question for a variety of reasons, such as their heightened awareness of substance abuse issues resulting from exposure to prevention programs in educational settings and their greater likelihood to experience interpersonal conflict and legal problems (Fulkerson, Harrison, & Beebe, 1999; Harrison, Fulkerson, & Beebe, 1998).

The analyses presented here are cross-sectional and represent the first attempt to describe the extent of CUD and other cannabis-related problems in this cohort. Because we sampled students from one university, the extent to which findings may be generalizable to other college student populations is unknown. Future analyses will take advantage of the longitudinal design of the study to explore how mental health, personality, and other factors are related to severity of cannabis-related problems and how changes in cannabis use might be associated with changes in problems during the time in college.

4.3. Implications

Despite these limitations, several important implications for research, policy, and prevention emerge from our findings. First, the prevalence of CUD and other cannabis-related problems are not trivial, and if replicated, these findings highlight the need for improved screening and early intervention for drug-related problems among first-year college students. Unlike other young adults, college students are a highly accessible population for prevention and treatment; therefore, college administrators and health professionals should implement policies and practices aimed at identifying students at risk for CUD and intervening early to prevent the development of more serious consequences such as academic failure and dropout. Campus policies regarding cannabis involvement should be evaluated thoughtfully with consideration for multiple alternative approaches. For example, compared with punitive disciplinary actions (e.g., placing a first-time offender on probation), health-oriented approaches (e.g., comprehensive psychosocial evaluation and treatment) may be more likely to succeed in changing the individual's behavior and longer-term trajectory. While a thorough evaluation of cannabis policies is beyond the scope of this paper, in this sample, punitive actions (housing violations, trouble with the law) were rare and were not related to the severity of cannabis involvement.

Because of the widespread use of cannabis among college students (Gledhill-Hoyt et al., 2000; Johnston et al., 2006) and strong evidence for the adverse health effects of regular use (Budney et al., 2004; Kalant, 2004), it is important to encourage more research on the longer-term consequences of cannabis use among college students. Many of the psychological effects of cannabis use are considered especially problematic for young people because of the potential for chronic use to interfere with the important developmental tasks of learning and personal

growth (Johns, 2001). Lower educational aspirations and achievement, higher risk of dropping out of school, lower occupational attainment, workforce failure, and difficulty finding one's purpose in life (Brook, Adams, Balka, & Johnson, 2002; Fergusson, Horwood, & Beautrais, 2003; Newcomb, Vargas-Carmona, & Galaif, 1999; Schuster, O'Malley, Bachman, Johnston, & Schulenberg, 2002) are all potential consequences of concern, with important implications for the college years and young adulthood. Depression is another possible effect of heavy cannabis use (Degenhardt, Hall, & Lynskey, 2003) and one of particular concern for college students considering the high risk for depression among young adults in their late teens and early twenties (SAMHSA, 2006).

The present findings also draw attention to the need for more research on the academic consequences of cannabis use among college students. In this study, among individuals who used cannabis at least five times in the past year, two in five (40.1%) cannabis users had difficulty concentrating after being high on cannabis and 13.9% missed class because of cannabis use. Although a substantial body of evidence exists to support a link between cannabis use and problems with academic performance among adolescents (see review by Lynskey & Hall, 2000), causality has not been established. Moreover, despite clear evidence of the adverse neurocognitive effects of cannabis use, it is unclear whether these effects have a direct impact on grades (Budney et al., 2004). Future studies with our cohort will help to address that question by observing whether cannabis-related problems with concentration and class attendance predict longer-term problems with grades and/or occupational attainment.

In this study, two of the other most prevalent problems cannabis users experienced pertain to the risk for physical injury. Among those who used cannabis at least five times in the past year, 24.3% put themselves in physically dangerous situations after using cannabis and 18.6% drove while they were high. These findings are concerning in light of prior evidence linking cannabis use with motor vehicle crashes and other accidental injuries (O'Kane, Tutt, & Bauer, 2002; Ramaekers, Robbe, & O'Hanlon, 2000; Woolard et al., 2003). In one study of college students, cannabis users were more likely to engage in other risky driving behaviors, such as non-use of seatbelts, driving after drinking, and riding with a driver who has been drinking (Everett et al., 1999). For these reasons, cannabis-related motor vehicle crashes may represent an important area of preventable injury for college students. Cannabis-using college students should be targeted for educational interventions aimed at reducing their risk for physical injuries.

Finally, the present findings are largely descriptive and draw attention to the need for a more thorough understanding of why some cannabis users experience problems while others do not. In this study, self-report data regarding problems that resulted from cannabis use were taken at face value and we did not attempt to objectively confirm the underlying causes of these problems. For example, for some students in this study, the problems they endorsed as being cannabis-related may have actually been exacerbated by concurrent use of other drugs. The present findings that CUD cases used significantly more illicit drugs than non-problematic cannabis users—and that cigarette-smoking cannabis users were at greater risk for CUD and certain cannabis-related problems than their non-cigarette-smoking counterparts—are consistent with prior evidence that cannabis-related problems are greater among polysubstance users (Looby & Earleywine, 2007). However, the present finding that frequent drinking did not increase the risk for CUD and other cannabis-related problems warrants further study. Moreover, prior research indicates that certain underlying affective and cognitive factors may heighten the risk for experiencing substance-related problems with respect to cannabis (Simons & Carey, 2002, 2006) and alcohol (Simons, Carey, & Gaher, 2004). Future studies with this cohort will examine how cannabis use fits into the context of illicit drug use over time, and the possible influence of underlying temperament, familial, contextual, and psychological factors on the persistence of drug problems throughout college.

In conclusion, this study addresses an important gap in the literature on CUD and other cannabis-related problems in college students. College students who use cannabis are at risk for a number of cannabis-related problems, even if they are not using heavily and do not meet the clinical definitions for abuse or dependence. If replicated, these findings may have important implications regarding the burden of cannabis-related problems among college students.

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Abbreviations

CUD, Cannabis Use Disorders.

Table 1
Prevalence of cannabis use disorders among first-year college students and cannabis users.

	<i>n</i>	%wt	Prevalence			
			Among All First-Year Students (<i>n</i> _{wt} =3219)	Among All Past-Year Cannabis Users (<i>n</i> =739)	Among "At-Risk" Cannabis Users <i>a</i> (<i>n</i> =474)	Among "Regular" Cannabis Users <i>b</i> (<i>n</i> =140)
Dependence (3 or more of the following criteria)	75	4.0	10.1	15.8	38.6	
Great deal of time spent obtaining, consuming, or recovering	154	8.0	20.9	32.6	60.7	
Tolerance	128	6.7	17.3	27.0	51.4	
Giving up important activities (social, occupational, recreational)	68	3.5	9.2	14.4	25.9	
Continued use despite knowledge of physical or psychological problems	58	3.1	7.9	12.3	21.4	
Unsuccessful efforts to cut down	48	2.6	6.5	10.1	26.4	
Consuming larger amounts than intended	44	2.3	6.0	9.3	20.1	
Abuse (1 or more of the following criteria)	107	5.4	14.5	22.6	28.6	
Regularly used and put self in physical danger	115	5.7	15.6	24.3	42.1	
Continued use despite problems with family or friends	50	2.9	6.8	10.6	19.4	
Serious problems at home, work, or school	36	2.0	4.9	7.6	15.0	
Repeated trouble with the law	11	0.5	1.5	2.3	4.3	
Diagnostic Orphans (1-2 dependence criteria, 0 abuse criteria)	93	5.0	12.6	19.6	15.7	
Non-Problematic Use ^c	199	11.8	62.8	42.0	17.1	

a "At-Risk" users are those who used cannabis at least 5 times in the past year.

b "Regular" users are those who used cannabis at least 6 times in the past month (Andersson et al., 2007).

c Individuals who used cannabis fewer than 5 times were not assessed for CUD, but were automatically coded for the absence of each CUD criterion, in order to permit prevalence computations for all students (*n*=3219) and all past-year cannabis users (*n*=739).

Table 2
Comparison of dependence, abuse, diagnostic orphans, and non-problematic use, among 474 “at-risk” cannabis users.

	Overall (n=474)	Non-Problematic Use (n=199)	Diagnostic Groups Based on DSM-IV Criteria		χ^2 (df)
			Diagnostic Orphans (n=93)	Abuse (n=107)	
Number of DSM-IV Criteria					
Abuse		0	0	1 to 4	
Dependence		0	1 to 2	0 to 2	
Cannabis-Related Problems (Percent)					
During the past 12 months, did you ever have concentration problems after being high on marijuana?	40.1	27.1 ^{bc}	34.4 ^e	43.9 ^{bf}	76.0 ^{c e f} 48.4 (3)
During the past 12 months, how often did you use marijuana and then drive a car, either your own or someone else's?	18.6	9.6 ^{bc}	12.9 ^{de}	24.3 ^{bdf}	41.3 ^{c e f} 36.2 (3)
During the past 12 months, did using marijuana ever cause you to oversleep and miss class?	13.9	7.0 ^{ac}	15.1 ^{ae}	13.1 ^f	32.0 ^{c e f} 25.2 (3)
During the past 12 months, did you have any problems with friends that were probably caused by using marijuana?	8.4	2.0 ^{bc}	2.2 ^{de}	16.8 ^{bd}	21.3 ^{ce} 28.5 (3)
During the past 12 months, did you have any problems with family that were probably caused by using marijuana?	8.0	0.0	1.1 ^{de}	15.9 ^d	26.7 ^e 12.8 (2)
During college, how many times did you get into trouble for a housing violation due to drug use?	3.0	1.5	1.1	4.7	6.7 6.2 (3)
Characteristics of Cannabis Use (Mean, SE)					F (df)
Age of onset	15.7 (.07)	16.1 (.11) ^{bc}	15.8 (.16) ^e	15.3 (.15) ^b	14.9 (.18) ^{c e} 13.7 (473)
Times used, past year	58.2 (3.7)	20.1 (4.5) ^{bc}	39.5 (6.6) ^{de}	75.0 (6.1) ^{bdf}	158.7 (7.3) ^{c e f} 92.4 (472)
Times used, past month	6.0 (.37)	2.6 (.47) ^{bc}	4.2 (.69) ^{de}	6.8 (.64) ^{bdf}	16.0 (.76) ^{c e f} 78.7 (472)
Number of other drugs used, past year	1.1 (.07)	0.6 (.10) ^{abc}	1.0 (.15) ^{ae}	1.3 (.14) ^{bf}	2.5 (.17) ^{c e f} 31.1 (473)

Table reflects data for 474 individuals who used cannabis 5 or more times during the past year. Diagnostic groups are based on DSM-IV criteria for cannabis abuse and dependence (American Psychiatric Association, 1994).

abcdef Pairs of letters denote statistically significant differences ($p < .05$) between groups, as indicated by pairwise comparisons in linear and log-linear regression models for continuous and categorical variables, respectively.

Prevalence of cannabis use disorders and cannabis-related problems, by frequency of drinking and past-year cigarette smoking, among 474 “at-risk” cannabis users.

Table 3

	Among Infrequent Alcohol Users ^a		Among Frequent Alcohol Users ^a		Prevalence		χ^2 (df)
	(n=235) %		(n=239) %		Among Cigarette Non-Smokers ^b (n=270) %	Among Cigarette Smokers ^b (n=204) %	
Cannabis Diagnostic Groups							
Cannabis Dependence	13.6	18.0	3.8 (3)	10.7	22.6	19.1 (3) ^c	
Cannabis Abuse	20.4	24.7		20.7	25.0		
Cannabis Diagnostic Orphans	21.3	18.0		19.3	20.1		
Non-Problematic Cannabis Use	44.7	39.3		49.3	32.4		
Other Cannabis-Related Problems							
Concentration problems after being high	37.9	42.3	.9 (1)	34.8	47.1	7.3 (1) ^c	
Drove while high	19.2	18.0	.1 (1)	14.4	24.0	7.0 (1) ^c	
Overslept and missed class	15.7	12.1	1.3 (1)	13.3	14.7	.2 (1)	
Problems with friends	8.5	8.4	<.1 (1)	7.8	9.3	.4 (1)	
Problems with family	8.1	8.0	<.1 (1)	6.7	9.8	1.6 (1)	
Housing violation for drug use	3.0	2.9	<.1 (1)	2.6	3.4	.3 (1)	

^a“Frequent” alcohol use was defined as drinking on 9 or more days in the past month; “infrequent” users drank 0 to 8 days in the past month.

^b Cigarette smokers were defined as smoking at least once during the past month.

^c Denotes statistically significant differences ($p < .05$).