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Marijuana Use and Intoxication Among Daily Users: An Intensive Longitudinal Study

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Abstract

Background—Most of the harm from marijuana use is experienced by daily users. Despite this, there has not been a detailed prospective description of daily marijuana use.

Methods—We recruited daily marijuana users (n=142) by internet ads, Craigslist, flyers, etc. Participants were mostly women (58%) with a mean age of 33 and 47% were minorities. Participants called an Interactive Voice Response phone system to report marijuana and other drug use daily for 3 months.

Results—Participants averaged using marijuana 3.2 times per day. Almost all participants used multiple modes of delivery during the study. Bongs/vaporizers/pipes was the most common mode of use (45% of uses). Day-to-day variability in amount of use was relatively small. The median rating of intoxication was 3.8 on a 0-6 scale with no intoxication reported on 1% of days and severe intoxication on 24% of days. The large majority binge drank (71%) or used tobacco (73%).

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Contributors

JRH, AJB, designed the study and wrote the protocol. JRF collected the data and JRF, PC conducted data analysis. JRH wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of interest: None

Fifteen during-study variables were associated with the frequency of marijuana use; running out of marijuana and social setting were the strongest correlates. Retrospective reports of “usual” use at study entry were often significantly different than daily reports of use during the study.

Conclusions—This is the first detailed prospective description of daily marijuana use. Most users used multiple times/day, used multiple modes to administer marijuana, were often intoxicated, and under-reported high rates of using alcohol and tobacco. The frequency of marijuana use was especially influenced by social factors. These results will help future studies better describe daily marijuana use.

Keywords

cannabis; drug substitution; intoxication; marijuana; natural history

1. Introduction

Marijuana is the most widely used illicit drug (www.samhsa.gov/data/NSDUH). Most of the physical and behavioral harm, dependence, and treatment seeking associated with marijuana use comes from daily users (Gordon A.J., Conley J.W., & Gordon J.M.,). The most recent US national survey estimates there are 5 million daily marijuana users (www.samhsa.gov/nsduh). Among yearly users of marijuana, 14% were daily or near-daily users (SAMHSA, 2008). The number of daily users in the US appears to be increasing as indicated by reports that the prevalence of dependence on marijuana (Stinson, Ruan, Pickering, & Grant, 2006; Compton, Grant, Colliver, Glantz, & Stinson, 2004) and the number seeking treatment for marijuana dependence (Office of Applied Statistics, 2007) have increased dramatically. In addition, the increased availability of marijuana due to legalization is likely to result in more daily users.

Typically, the first step in studying a behavior is to obtain a detailed description of the behavior; however, descriptions of daily marijuana use are limited (Temple, Brown, & Hine, 2010). There have been several large prospective studies that have revealed important information on how marijuana use changes over a lifetime (Kandel & Raveis, 1989; Chen & Kandel, 1998; Chen, Kandel, & Davies, 1997; Halikas, Weller, Morse, & Hoffmann, 1984; Swift, Hall, & Copeland, 2000; VonSydow et al., 2001; Aitken, DeSantis, Harford, & FeCaces, 2000; Hammer & Vaglum, 1990). These were studies of infrequent young adult users who were surveyed at 3-6 month intervals and focused on change occurring over intervals of several years. These studies only reported on “usual use” during the last several months. None provided a detailed description of day-byday use and none reported on use by daily marijuana users.

Surprisingly, we could only locate one study that quantified day-to-day use of marijuana among heavy users. This study examined 49 college students that used marijuana 5-6 times/week over a 2 week period (Buckner, Crosby, Silgado, Wonderlich, & Schmidt, 2012). It found marijuana use was greatest in the evening and when others were using marijuana, but was not greater on the weekends. Marijuana use was also associated with high craving and anxiety ratings.

We recently completed a study of changes in marijuana use among daily users who were contemplating reducing or quitting sometime in the next 3 months. On the large majority of days of the study, these users were not trying to change their marijuana use; thus, we thought that, before describing the changes in marijuana use, it would be helpful to provide a detailed description of marijuana use on such days for several reasons. For example, because of the multiple modes of administration of marijuana (e.g. blunts, bongs, joints, vaporizers, waterpipes) and the multiple topographies of marijuana use (e.g. depth of inhalation, sharing with others), it is difficult to know how to best measure marijuana use (Mariani, Brooks, Haney, & Levin, 2011; Cooper & Haney, 2009; Gray, Watson, & Christie, 2009). A detailed prospective description of real-world marijuana use that examined issues such as how often users used different modes of administration and how often they changed modes would be helpful both to understanding the consequences of marijuana use but also in designing treatments (Temple et al., 2010). Also, assessing whether daily users are likely to be more intoxicated and use other drugs would be of use. Finally, discovering the events that are associated with heavier use would be useful in designing treatment interventions. Although some of the above information has been described in retrospective reports of daily users in research studies, a prospective study of real-world use could provide a more valid and accurate measure of outcomes among daily users. To accomplish this, the current analyses focused on 1) the frequency, modality (e.g., joints vs. bongs) and variability of marijuana use, 2) possible causes of variability in use, 3) degree of intoxication and 4) concordance of retrospective reports of “usual” use compared to prospective daily reports of marijuana use. We focused on different modalities because recent reports suggest a growing variety of modes of use, and that different modes may differ in marijuana intake; e.g. blunts appear to deliver more delta(9)-tetrahydrocannabinol than joints (Cooper & Haney, 2009). We focused on causes of variability in use and intoxication levels because we could not locate prior studies of either among ongoing marijuana smokers. We also focused on the validity of recall of drug use because studies among tobacco users suggest such recall is poor (Shiffman et al., 1997).

2. Methods

2.1. Study Design

This a secondary analysis of a study whose primary aim was to describe attempts to change marijuana use among daily users and the study was designed to optimize that aim (the main analysis about changes has not been published). This secondary analysis was a natural history description and like most such analyses (Klingemann et al., 2001) did not have firm a priori hypotheses. We recruited daily marijuana users to a 3-month prospective, non-treatment study. Because the major aim of the study was to describe changes in marijuana use, participants had to state they probably or definitely intended to reduce or stop use at some point in the next 3 months. However, we found that, on the large majority of days (74%) during the study, participants were not trying to reduce or quit providing an opportunity to describe routine daily use among daily users.

Participants initially completed a survey on their “usual” use pattern and then called an Interactive Voice Response (IVR) system each morning to report the prior day's marijuana

use, intentional and non-intentional reduction or abstinence, intoxication level, circumstances that might be related to amount of use, mood, craving, and alcohol, tobacco, and illegal drug use. No in-person visits were required and no treatment was provided. All participants provided verbal consent. The University of Vermont Committees on the Use of Human Participants approved the study and the study was registered at www.clinicaltrials.com (NCT01039415).

2.2. Recruitment

Major inclusion criteria were a) 18 years old, b) using marijuana at least 5 of 7 days/week, c) scored < 3 on the Severity of Dependence Scales (SDS) (Lawrinson, Copeland, Gerber, & Gilmour, 2007) for dependence on alcohol and non-marijuana illicit drugs, d) stated probably or definitely will try to reduce or stop marijuana use at some point in the next 3 months, and e) had no pending legal actions. The most common reason for exclusion was not stating they either probably or definitely would try to reduce or quit in the next 3 months (Figure 1). Almost all of those eligible consented.

Participants were recruited from throughout the US between 1/1/10 and 3/27/12. We recruited participants by notices the on-line bulletin board www.craigslist.com (30% of those enrolled), internet ads (23%), participant referrals (16%), flyers (8%), bus ads (3%) and newspaper ads (2%). A typical ad statement was “Thinking of reducing or quitting marijuana use? You are wanted for a research study. Marijuana users needed for multiple phone interviews. Compensation is available. No treatment is provided. This is a NIH funded research study.” Our target sample size of 200 was based on the ability to accurately estimate incidence rates of various events. A sample of 200 would produce a 95% confidence interval of $\pm 7\%$ or less, depending on the incidence rate (Fleiss, 2003).

Of the 237 who were eligible and consented, 39 were dropped from the study because they were initially noncompliant (i.e., missed 3 calls in the first week). To obtain a sufficient sample of both weekdays and weekend days we required 14 days in which participants were not trying to change. This excluded another 56 participants (e.g. those who were abstinent most of the study); thus, 142 (60% of those consented) provided data for the current analysis. Those excluded were more likely to be men (62% vs. 42%, $p < .05$), White (73% vs. 53%, $p < .05$) and had less intention to quit (59% vs. 32% endorsed probably rather than definitely planning to quit, $p < .05$). None of these differences were associated with frequency of marijuana use (see below).

2.3 Sample Characteristics

Participants completed baseline information via a website or paper questionnaires. Participants were evenly distributed between men and women, minorities and Whites, and employed and unemployed (Table 1). Few were married and most had post-high school education. At study entry, participants stated they usually used marijuana 6 days/wk (median), and on the days they used, averaged 4 (median) times used/day. Few reported using marijuana for medical reasons (11%), or having been in treatment for marijuana problems (11%). Half stated they “usually” used joints (53%), blunts (51%), or pipes (55%)

weekly, and fewer reported using bongs (32%), vaporizers (6%) or marijuana substitutes (3%) weekly.

Most (63%) met criteria for DSM-IV cannabis dependence using a self-report version of the DSM checklist (Hudziak et al., 1993) and a few more (11%) met criteria for cannabis abuse only (American Psychiatric Association, 2000). Most (80%) scored ≥ 3 (i.e., above recommended cut off) on the SDS (Swift, Copeland, & Hall, 1998) when applied to marijuana. The mean rating of addiction to marijuana was 6.7 (sd = 2.5) on a 0-10 scale (0 = not at all addicted, 10 = very addicted) similar to a scale validated for use in tobacco smokers (Hughes, Keely, Fagerstrom, & Callas, 2005). The mean number of problems on the Cannabis Problems Scale (CPS) (Stephens, Roffman, & Curtin, 2000) was 6.4 (4.5) out of a possible 18 problems.

Upon study entry, 9% stated they had five or more alcoholic drinks on one occasion (i.e., binge drank) at least monthly. Half of participants reported they were current cigarette smokers (55%; 42% daily and 13% nondaily smokers). A quarter (23%) were former smokers, and a quarter (23%) were never-smokers. Few (15%) stated they had used a non-marijuana illegal drug in the last 3 months.

To interpret the generalizability of our sample, we obtained descriptions of daily marijuana users in a) a study of users who were considering changing their marijuana use (Stephens, Roffman, Fearer, Williams, & Burke, 2007), b) daily marijuana users from National Survey of Drug Use and Health (www.nsduhweb.rti.org), c) treatment seekers from the Treatment Episodes Data Set (www.dasis.samhsa.gov), and d) research volunteers from the two largest prior randomized controlled trials on marijuana treatment of users committed to quitting (Marijuana Treatment Project Research Group, 2003; Kadden, Litt, Kabela-Cormier, & Petry, 2007) (Table 1). Our sample appeared to have a similar age, minority prevalence, age of onset, frequency of marijuana use, and prevalence of marijuana dependence to most comparisons samples. However, our sample appeared to have fewer men, fewer with a high school education or less, fewer married, and fewer employed than most comparison samples.

3. Measures

3.1. Interactive Voice Response (IVR)

Participants called an IVR system by phone each morning to report marijuana and other drug use for the prior day. The IVR is a system in which participants respond to phone questions by entering data using the phone keypad (Corkrey & Parkinson, 2002). IVR has many of the assets of computer-assisted telephone interviewing; e.g., automatic skips, branching options, prohibition of illogical responses and outliers, standardized questioning, and direct data entry. Drug use outcomes are more validly reported in IVR compared to phone interviews, computer assessments, written questionnaires or in-person interviews (Aquilino, 1992; Kobak et al., 1997). Daily reporting via IVR appears to produce little reactivity (Hufford, Shields, Shiffman, Paty, & Balabanis, 2002); (Hughes et al., 2013; Helzer, Badger, Rose, Mongeon, & Searles, 2002).

How best to quantify marijuana use is unclear (Zeisser et al., 2012; Gray et al., 2009). On every day of the first week, the IVR initially stated, “Every day we will ask you about your marijuana use. We will ask you both about your times of use and about the total number of joints. A time of use can be long or short but has to be separated from the previous time of use by at least one hour. The number of joints is the total number you smoked all day no matter how many times of use you had. If you use marijuana substitutes like K2, Spice, or Mr. Nice Guy, please count this as marijuana use and include it when you report the number of times you used marijuana and when you report the total number of joints, pipes, or bowls” We chose “times” of use because the largest studies of daily users (e.g., the Marijuana Treatment Project); (Stephens, Babor, Kadden, & Miller, 2002) suggest this is a valid measure. Participants were asked about blunts, bongs/pipes /vaporizers/waterpipes (any of these), and foods containing marijuana they used. Participants were also asked about nine events (e.g., seeing someone use – yes/no) and six internal states (e.g., anxiety – some or a lot vs. none or little) that might predict use of marijuana, as well as the number of alcoholic beverages and cigarettes they used each day. The events and internal states were chosen based on our review of the literature (Lee, Neighbors C., Hendershot, & Grossbard, 2009) and our own experience in interviewing daily marijuana users and are listed in Table 2. An example of an event question is “Yesterday, did you see someone else use marijuana?” with a yes/no response. An example of an internal state question is “How sad or depressed were you yesterday?” with ratings of not all, a little, some, a lot. Endorsement of the last three options was classified as a yes.

Participants were reimbursed \$2 for daily IVR completion plus a \$10 bonus if they completed all IVR calls in a week. They also received \$75 for completion of questionnaires. The total maximum amount available was \$363.

4. Data Analysis

All descriptive summary statistics (e.g. percents) were calculated by first averaging within participants, and then averaging across participants, so that each participant provided the same amount of data. Multilevel models were used to account for the difference in within- vs. between-participant variability. Missing data was not imputed. Most of the outcomes had skewed distributions; thus, we report medians and non-parametric statistical tests. The analyses used SAS version 9 (SAS Institute, Cary, NC).

5. Results

5.1. Compliance

Among the 142 participants in the current analysis, the incidence of missing data was 8%, and the incidence of dropouts (i.e. did not provide data in the last week of the study) was 5%. Comparable rates among the 198 who entered the study were 16% and 13%.

5.2. Reactivity

Self-monitoring can cause “reactivity;” i.e., a decrease in reports of a behavior (Korotitsch & Nelson-Gray, 1999). The median number of times marijuana was used in the first week of the study on days participants were not trying to change was lower than the number of times

of use in a “usual” week reported on the baseline survey (3.4 vs. 4.1 times used/day, Wilcoxon signed rank test, $p = .003$). We do not know if this reduction represents reactivity, inaccurate reporting of “usual” number of times used, or unreported attempts to reduce.

5.3. Patterns of Marijuana Use

Participants reported use without an attempt to change on 62% of days, and of non-intentional reduction (e.g. due to non-availability of marijuana) on 12% of days; thus, a total of 74% of days (i.e., a median of 73.5 days) were included in the current analysis. The remaining days were excluded due to intentional reduction (13%), intentional abstinence (9%), and non-intentional abstinence (3%).

The median number of times used/day was 3.0 (2.2-3.8) and 83% users averaged 2 times used/day. The number of times used/day declined slightly over the 84 days of the study from 3.4 during the first week to 3.0 during the last week (multilevel regression $p < .0001$). Marijuana use was slightly greater on weekend than weekdays (Table 2). Almost all participants used different modes of marijuana administration during the study and joints were not the most common mode of administration. For example, 59% used all three modes during the study while less than 3% used only joints or only blunts (Figure 2). Overall 7% used only one mode during the study, 25% used two modes, and 59% used three modes or more. Participants used pipes/bongs on a median of 49% of days, blunts on 33% of days, and joints on 16% of days. African Americans were more likely to use blunts than Whites (72% vs. 20% of days; ANOVA, $F = 11.0$, $p < .0001$). The median number of times used/day of bongs/pipes was 2.5 day (1.7-3.7), of joints was 2.0/day (1.3-3.1), of blunts was 2.2/day (1.5-3.3). The daily sum of the number of times used of bongs/pipes, blunts, joints and food on a usual use day was equal to 74% of the number of “times” used, indicating some “times of use” included multiple modes of administration. The median within-participant standard deviation in the number of times used was 1.1; thus, on 68% of the days, the number of times used differed from the mean by 1.1 times used.

5.4. Intoxication/High Scores

On days when marijuana was used, the median high score was 3.8 (3.2, 4.6) on a 0-6 scale with 0 = “did not get high” and 6 = “got very high”; i.e., on 50% of days, users reported a score of 3.8. The median incidence of days of little intoxication (rating = 0 or 1) was 1% and of days of severe intoxication (ratings = 5 or 6) was 24%. Higher intoxication scores were associated with greater times of use/day (multilevel regression $p < .0001$, median within-participant correlation = .40) and greater number of modes of administration used/day (median correlation = .41, $p < .0001$), suggesting equal validity of these two measures. Average intoxication scores were greater in those with higher SDS for marijuana scores (univariate regression, $r = .20$, $p = .03$), higher self-reported addiction scale scores ($r = .26$, $p = .006$), and higher baseline marijuana intake ($r = .19$, $p = .05$). Intoxication scores were higher on days participants used blunts than on days they used joints or pipes (4.3 vs. 3.7, multilevel regression $p < .0001$) and on days they used any alcohol (4.1 vs 3.7, multilevel regression, $p < .0001$) or binge drank (4.4 vs 3.9, multilevel regression, $p < .0001$). Among daily tobacco smokers, intoxication scores were higher on smoking than non-

smoking days (3.9 vs 3.5, multilevel regression, $p < .0001$) and increased with increased cigs/day (+0.05/cigarette; multilevel regression, $p < .0001$).

5.5. Use of Other Drugs

Almost all (91%) of participants consumed alcohol during the study and those who did, drank alcohol on 21% of days with a median number of 2.7 drinks (2.0-3.8) on a day of drinking. Most (72%) alcohol users binge drank (5 drinks for men and 4 drinks for women) at least once during the study and 30% binged monthly. Most participants (73%) smoked tobacco during the study. Among those who smoked, 42% were non-daily smokers. Among daily smokers, the median cigs/day was 9.6 (5.9, 16.9). Smoking was more common among primary blunt/joint users (chi-square = 7.7, $p < .02$). One-third (33%) of participants reported use of 1 non-marijuana illicit drug during the 3 months of the study, but only 9% used illicit drugs 5 times during the study

5.6. Prediction of Number of Times of Use

None of the baseline demographic variables (see Table 1) predicted the number of times used. Among the other baseline variables, age of onset, number of marijuana problems, number of friends using, partner use, social use, use for medical reasons, and support for legalization of marijuana did not predict frequency. Self-rated and DSM-defined dependence, and ease of obtaining marijuana predicted greater times of use (all p 's $< .05$). None of the alcohol use nor mood variables predicted frequency, but tobacco smokers used marijuana less frequently (2.9 vs. 3.2 times used/day; $F = 4.9$, $p < .05$).

In contrast, all 15 variables collected daily during the study were associated with times used (multilevel univariate regressions; all p 's $< .05$) (Table 2). Running out of marijuana and seeing someone using marijuana appeared to be the strongest correlates, followed by using with someone, being at a party, and being offered marijuana. In a multilevel multivariate regression testing which variables were associated with times used independent of other variables, eight variables; (i.e., the above five variables plus drinking alcohol, anxiety, and craving) remained as significant correlates.

6. Discussion

Most daily marijuana users used marijuana multiple times/day and half used more than 3 times/day. The large majority of marijuana natural history, epidemiological and treatment studies report only the number of joints being used; however, the large majority of daily users in our study used multiple modes of administration and joints, in fact, were not the most commonly used mode of administration. In addition, social factors and availability were the two most powerful predictors of marijuana which is consistent with the one prior detailed prospective study (Buckner et al., 2012) Marijuana use was slightly greater on weekends than weekdays in the current study, which is inconsistent with the prior study.

To our knowledge, this is the first study to assess daily levels of intoxication from marijuana. Most of our daily users were chronically intoxicated; i.e., they do not appear to have developed substantial tolerance to intoxication effects. This suggests many, if not most, daily users are likely to have impaired cognitive function and decision making on a daily

basis (Crean, Crane, & Mason, 2011). Consistent with retrospective studies (Timberlake, 2009) Use of blunts was associated with greater intoxication than use of joints. Although this appears to contradict a laboratory study that found with similar weights of marijuana, intoxication was greater with joints than blunts (Cooper & Haney, 2009). However, blunts typically contain more marijuana than joints (Mariani et al., 2011), and this may be the reason for their association with greater intoxication.

Almost all participants used alcohol, and users averaged 4-5 alcoholic drinks/week, which is identical to recent national survey data for alcohol users (Saad, 2012). During the study about 30% of participants binge drank monthly which does not appear to be higher than the national average for adults in this same age range (28%) (Kanny, Liu, Brewer, Lu, & Centers for Disease Control and Prevention (CDC), 2013). Non-marijuana illicit drug use was uncommon, probably due to our inclusion criteria.

About 3/4ths of our daily users smoked tobacco during the study, which is similar to that seen with heavy users of other illicit drugs (Peters, Budney, & Carroll, 2012). However, among those who smoked, only 60% were daily smokers and these daily smokers averaged 10 cigs/day, both of which are less than among US adult smokers (King, Dube, & Tynan, 2012). There are several plausible hypotheses about why the prevalence of tobacco smoking is so high among daily marijuana users (e.g. similar routes of administration, and offsetting of sedating effects of marijuana); however, empirical tests of these are lacking (Peters et al., 2012). Since, tobacco smoking is likely a major cause of morbidity among marijuana users and is associated with decreased cessation of marijuana (Peters et al., 2012), further research into the overlap of tobacco and marijuana use is indicated.

The use of alcohol and cigarettes during the study was much greater than the “usual” use reported at study entry. For example, at study entry, only 9% reported monthly binge drinking, but 72% binged during the 3-month study; 55% stated they were current tobacco smokers, but 73% smoked during the study; and also at study entry; 15% stated they used an illegal drug in the last 3 months, but 33% used during the 3 month study. These results suggest retrospective report of “usual” use of drugs can be quite inaccurate. Similar results have been found for tobacco use (Shiffman, 2009).

Several during-study variables predicted increased marijuana use; however, the magnitude of most of these effects was small (difference of 0.4 times used/day). The stronger correlates were running out of marijuana, seeing someone use marijuana, and using with someone. This result confirms prior retrospective reports that social influences are prominent in determining the amount of marijuana use (Buckner et al., 2012).

One possible liability of our study is that the daily monitoring appeared to suppress marijuana use. We believe this may not be the case because the effect occurred immediately (i.e., within the first week) which is different from most reactivity effects (Korotitsch & Nelson-Gray, 1999). Also, the difference in baseline vs, during study use may be due to overestimating usual use at baseline rather than reactivity per se or intentional reductions during study.. Another liability of the current study was its use of a convenience sample. Although the sample was similar to national samples of daily users on many demographic

and use characteristics, it did have substantially fewer men and fewer less-educated participants than most comparison samples of daily users. Also, our participants were daily marijuana users who were planning to reduce or quit at some point in the next 3 months and who were not currently dependent on alcohol or non-marijuana illicit drugs. Clearly our sample was not representative. Unfortunately, we a priori lumped bongos, pipes, vaporizers and waterpipes together because at study onset we were not aware each was so prevalent. We also did not collect data on co-administration of marijuana with other drugs. Our results are based on prospective prediction and although such associations are more likely to be causal than cross-sectional or retrospective associations, they still may not represent a causal relationship. For example, the variables in Table 2 could be consequences rather than causes of increased marijuana use. Non-substance use psychiatric comorbidity is common among heavy marijuana users (Satyanaravana, 2009); however, we did not measure this in our sample. Finally, we did not collect biological samples to verify levels of use. The major assets of our study were the use of non-treatment seeking sample, the prospective design, the small amount of missing data, and the multiple data points for each participant

Our study has several possible implications. First, since daily marijuana users are quite heavy users and are often intoxicated, they are a group that should be targeted for interventions. Second, since almost all daily users used multiple modes of administration, future clinical and epidemiological descriptions need to include measures of multiple modes to adequately describe use patterns and outcomes. Third, since “times used” was as correlated with intoxication levels as number of different modes of administration used, it may be thought of as a simpler, more easily operationalized quantity measure than asking about the six different modes of administration. On the other hand, since blunts were associated with greater intoxication levels, future studies of the relative speed of onset and maximum level of THC across the modes of administration is needed to determine if exposure to marijuana constituents differs across modes. Fourth, since the use of alcohol and tobacco during the study was significantly greater than that reported as “usual,” future studies may want to use prospective or retrospective Time-Line Follow-Back procedures (Sobell, Brown, Leo, & Sobell, 1996) to obtain a more accurate measure of their use. Fifth, our finding that social factors were the most important factors in determining marijuana use replicates earlier work with less-heavy users (Chen & Kandel, 1998) and suggests that, even with the progression to daily marijuana use, much use continues to be occurring in social settings. Finally, since we had little missing data and since there appeared to be little reactivity with daily monitoring, this suggests the feasibility of further prospective natural history studies of subsets of marijuana users.

In summary, our major findings are that daily marijuana users a) use multiple times each day, b) use multiple modes of administration (not just joints), c) are often intoxicated, d) have high rates of tobacco use, e) are often influenced by social cues to use and f) underreport alcohol and tobacco use. Since this is one of the first intensive studies of daily marijuana use, replications are needed, including replications in a more generalizable sample and among less heavy marijuana users and users not contemplating changing.

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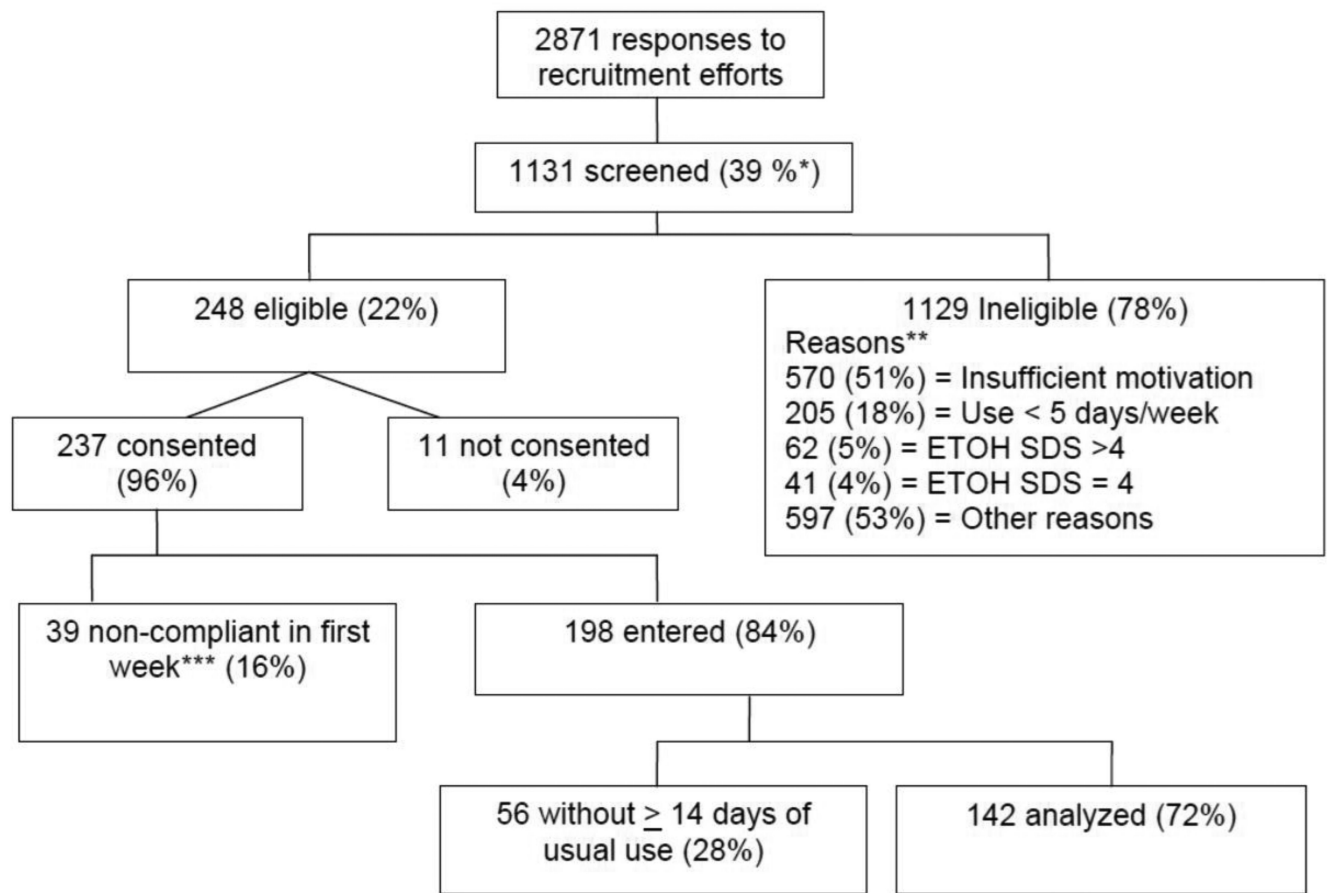
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Highlights

- Most daily marijuana users use multiple methods of delivery
- Most report significant daily intoxication
- Most binge drank and were tobacco smokers
- Replication in a more generalizable sample is needed



* All percentages are of amount in box above.

** Some participants had more than one exclusion criteria.

***Participants who miss 3 or more calls in the first week, or who don't return the initial survey.
ETOH = alcohol, SDS = Severity of Dependence Scale

Figure 1.
Participant Flow

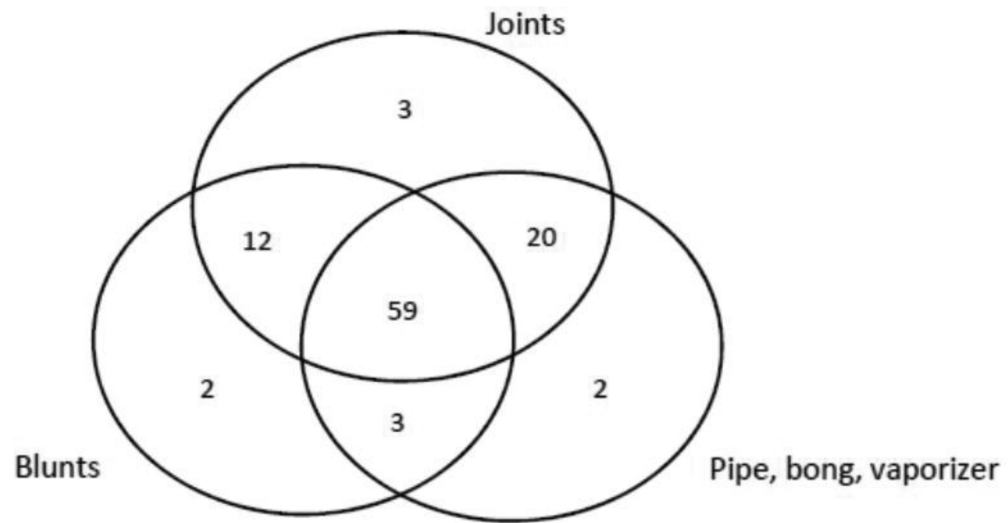


Figure 2. Percent of participants who used a single mode of marijuana administration or used different modes during the study. The subsets are mutually exclusive.

Table 1

Participant Characteristics in the Current Study Compared to Other Populations of Daily Marijuana Users

	Current study	Ambivalent users	Population-based users	Real world treatment seekers	Treatment research volunteers	
	(n = 142)	MJ Check-Up, 2007 (n=587)	2010 NSDUH (n= 1323)	2010 TED clients (n = 10,698)	MJ Tx Project, 1997 (n = 360)	Kadden, 2007 (n = 240)
Mean age	33	30	-	-	36	33
% Women	58	25	30	49	32	29
% HS education	29		51	85	-	-
% Married	14		24	12	40	55
% Minority	47	16	32	62	30	40
% Employed	48		68	17	83	73
Age of onset of mj use	15		15	15	-	-
Times used/day	4	3	-	-	4.5	4.5
% Mj abuse or dependence*	80		22	91	100	100

HS = high school, MJ = marijuana, Tx = treatment, NSDUH = National Survey on Drug Use and Health, TED = Treatment Episode Data Set

* Samples varied on criterion for abuse/dependence

Table 2

Significant Correlates of Greater Number of Times Used Marijuana

Predictor	Median percent of days	Times used MJ on day of occurrence	Times used MJ on day of non-occurrence ^a	t statistic from multilevel linear regression
Events				
At a party	6 (2, 16)	3.5 (2.6, 4.6)	3.1 (2.3, 3.9)	11.91 **
Binge drinking (n=86)	6 (2, 13)	3.2 (2.6, 4.8)	3.1 (2.4, 3.7)	10.20 **
Concerns about cost of MJ	5 (1, 22)	3.0 (2.4, 4.0)	3.1 (2.4, 4.1)	-2.41 *
Offered marijuana	30 (12, 57)	3.3 (2.5, 4.2)	2.9 (2.1, 3.6)	14.91 **
Ran out of MJ	6 (1, 13)	2.6 (1.9, 3.2)	3.2 (2.4, 4.1)	-15.34 **
Seeing someone using	66 (28, 92)	3.2 (2.5, 4.1)	2.6 (1.8, 3.5)	15.02 **
Used alcohol (n=129)	21 (8, 46)	3.3 (2.3, 4.3)	3.0 (2.2, 3.8)	10.58 **
Using with someone	61 (25, 91)	3.2 (2.6, 4.2)	2.6 (1.8, 3.3)	15.25 **
Weekend	43 (41, 45)	3.1 (2.4, 4.1)	3.0 (2.2, 3.8)	7.57 **
Internal States (none vs any)				
Anger	21 (8, 44)	3.0 (2.2, 3.9)	3.1 (2.4, 4.0)	-3.94 *
Anxiety	21 (5, 55)	3.0 (2.2, 3.9)	3.1 (2.3, 4.1)	-2.05 *
Craving	96 (85, 100)	3.1 (2.4, 4.1)	2.8 (2.0, 4.0)	4.96 **
Sadness	21 (6, 53)	3.0 (2.2, 3.7)	3.1 (2.4, 4.0)	-3.86 **
Hunger	83 (58, 95)	3.1 (2.4, 4.0)	2.9 (2.0, 4.0)	6.15 **
Sleep problems	27 (9, 48)	3.0 (2.3, 3.8)	3.1 (2.3, 4.0)	-2.39 *

Medians (25th and 75th percentiles). Retained subsets of participants for drinking and bingeing.

MJ = marijuana

^a p values for difference in marijuana use on days of occurrence vs. non-occurrence of event

* p < .05

** p < .001

*** p < .001