Marijuana use and intoxication among daily users: An intensive longitudinal study

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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.

ARTICLE INFO

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 were 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%). 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.

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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 come from daily users (Gordon, Conley, & Gordon, 2013). The most recent US national survey estimates that 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 (Compton, Grant, Colliver, Glantz, & Stinson, 2004; Stinson, Ruan, Pickering, & Grant, 2006) 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

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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 (Aitken, DeSantis, Harford, & FeCaces, 2000; Chen & Kandel, 1998; Chen, Kandel, & Davies, 1997; Halikas, Weller, Morse, & Hoffmann, 1984; Hammer & Vaglum, 1990; Kandel & Raveis, 1989; Swift, Hall, & Copeland, 2000; VonSydow et al., 2001). 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-by-day 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 was found that 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 the administration of marijuana (e.g. blunts, bongs, joints, vaporizers, and waterpipes) and the multiple topographies of marijuana use (e.g. depth of inhalation and sharing with others), it is difficult to know how to best measure marijuana use (Cooper & Haney, 2009; Gray, Watson, & Christie, 2009; Mariani, Brooks, Haney, & Levin, 2011). 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 not only in 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 that 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 that 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 that they either probably or definitely would try to reduce or quit in the next 3 months (Fig. 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 ± 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 on 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 the 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 that 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 that 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