



Antecedents and consequences of cannabis use among racially diverse cannabis users: An analysis from Ecological Momentary Assessment



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ABSTRACT

Background: Cannabis remains the most commonly used illicit substance and use rates are rising. Notably, the prevalence of cannabis use disorders (CUD) nearly equals that of other illicit substance use disorders combined. Thus, the present study aimed to identify cognitive, affective, and situational predictors and consequences of ad-lib cannabis use in a racially diverse sample.

Methods: The sample consisted of 93 current cannabis users (34.4% female; 57.1% non-Hispanic Caucasian), 87.1% of whom evinced a current CUD. Ecological Momentary Assessment was used to collect frequent ratings of cannabis withdrawal, craving, affect, cannabis use motives, and peer cannabis use over two weeks. Mixed effects linear models examined within- and between-day correlates and consequences of cannabis use.

Results: Withdrawal and craving were higher on cannabis use days than non-use days. Withdrawal, craving, and positive and negative affect were higher immediately prior to cannabis use compared to non-use episodes. Withdrawal and craving were higher among those who subsequently used cannabis than those who did not. Cannabis use resulted in less subsequent withdrawal, craving, and negative affect. Enhancement and coping motives were the most common reasons cited for use. Withdrawal and negative affect were related to using cannabis for coping motives and social motives. Participants were most likely to use cannabis if others were using, and withdrawal and craving were greater in social situations when others were using.

Conclusions: Data support the contention that cannabis withdrawal and craving and affect and peer use play important roles in the maintenance of cannabis use.

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1. Introduction

Cannabis is the most commonly used illicit drug and nearly one-fourth of users meets criteria for a cannabis use disorder (CUD; Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). Rates of CUD nearly equal that of other illicit substance use disorders combined (SAMHSA, 2013). Further, cannabis use is on the rise (SAMHSA, 2013). It is therefore important to determine whether putative proximal 'high-risk' cannabis vulnerability factors are in fact related to use. Tension-reduction-based models

of substance use (e.g., Conger, 1956) propose that substances may be used in an attempt to relieve unpleasant physical and/or emotional states such as withdrawal, craving, and negative affect. Consistent with these models (e.g., Khantzian, 1997), substance use is maintained if the desired effect is achieved (i.e., substance produces alleviation of negative state). The incorporation of Ecological Momentary Assessment (EMA) into prospective designs is one way to test the utility of tension-reduction-based models. Benefits include: collection of data in real-world environments; minimization of retrospective recall bias; and aggregation of observations over multiple assessments facilitating within-subject assessments across time and context, permitting the examination of both predictors and consequences of use (Shiffman et al., 2008).

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There is some evidence that withdrawal, craving, and negative affect are ‘high-risk’ cannabis use factors. Withdrawal is related to cannabis relapse (Cornelius et al., 2008) and was cross-sectionally related to cannabis use following a self-quit (i.e., no treatment) attempt in a pilot EMA study of 30 cannabis users (Buckner et al., 2013). Craving does not only occur in the context of withdrawal (see American Psychiatric Association [APA], 2013). Thus, it is important to assess whether craving specifically is related to use and extant data suggest it may be. THC administration decreases craving (Haney et al., 2008) and in a pilot study of 49 Florida State University (FSU) undergraduates, craving was higher prior to cannabis use and lower following use (Buckner et al., 2012a). Similarly, cannabis users report using cannabis to cope with stress and anxiety (Hathaway, 2003; Ogborne et al., 2000). Further, although both positive and negative affect were higher during cannabis use than non-use episodes in our pilot study of self-quitters, only negative affect was uniquely related to use (Buckner et al., 2013).

There remain several gaps in our understanding of putative high-risk cannabis use maintenance factors. First, no known studies assessed momentary motives for cannabis use among users not undergoing a quit attempt. Thus, although coping, enhancement, and expansion motives tend to be most strongly related to cannabis use when assessed via retrospective assessments (e.g., Buckner et al., 2007; Simons et al., 2000), it is unknown whether these motives proximally predict use. Second, although tension-reduction-based models posit that cannabis use should result in decreases in unpleasant states, we know of no EMA studies testing whether cannabis use results in decreases in withdrawal and/or negative affect. Third, the majority of research on withdrawal has concerned individuals undergoing quit attempts, limiting information about the role of withdrawal among non-treatment seekers. Fourth, although the majority of cannabis use occurs when others are also using (Buckner et al., 2012a, 2013), it is unknown whether greater use in social situations is for social reasons and/or due to increases in cannabis withdrawal or craving in response to cannabis-related cues (e.g., peers’ paraphernalia). Fifth, the vast majority of work has relied on data from predominantly Caucasian samples (e.g., Buckner et al., 2007, 2012a, 2013; Simons et al., 1998, 2000) or relatively small samples of diverse participants (e.g., $n=8$; Haney et al., 2008). It is unknown whether results generalize to more racially/ethnically diverse samples.

The present study sought to further understanding of factors that maintain cannabis use in a racially diverse sample of community-recruited adult cannabis users using EMA to collect real-world data about ad-lib cannabis use episodes over a two-week period. The cross-sectional and prospective relationships between putative cannabis use vulnerability factors (e.g., cannabis withdrawal, craving, affect) and cannabis use were examined. It was predicted that these factors would be cross-sectionally and prospectively related to use. Specifically, it was predicted that (1) these symptoms would be greater on cannabis use days than non-use days, (2) these symptoms would be positively related to cannabis use at each assessment point, and (3) these symptoms at one assessment point would predict cannabis use at the next assessment point. Consistent with tension-reduction-based models, it was also predicted that cannabis use would result in subsequent reduction in the severity of these symptoms. Further, per prior work (Buckner et al., 2007; Simons et al., 2000), it was hypothesized that coping, enhancement, and expansion motives would be the most commonly reported motives for use. We also tested whether withdrawal and negative affect were significantly related to coping motivated use. Finally, we sought to extend prior EMA work (Buckner et al., 2012a, 2013) by testing whether use of cannabis by others was related to greater cannabis withdrawal, craving, and negative affect.

2. Materials and methods

2.1. Participants

Participants were recruited via community advertisements (e.g., flyers, newspaper ads). Interested participants completed a screening (on-line or telephone) and baseline appointment to determine eligibility. Participants were asked to refrain from cannabis use the day of their appointment. Eligibility criteria included being between 18 and 45 years old, past-month cannabis use (confirmed via urine sample using a 50 ng/ml positive cutoff), cannabis as drug of choice, and no interest in, or current receipt of, substance use disorder treatment. Of the 125 people who attended a baseline appointment, 1 refused to participate and 14 were excluded due to: negative biological verification of cannabis use ($n=6$), being under the influence of cannabis during assessment ($n=1$), meeting DSM criteria for primary substance dependence other than cannabis dependence ($n=3$), and meeting criteria for other diagnoses (e.g., psychosis) that would preclude participation ($n=4$). Of the 110 participants enrolled, 8 dropped out during the monitoring period and 9 were excluded due to: equipment malfunction ($n=7$), non-compliance with protocol during check-in appointments ($n=1$), and non-compliance with EMA data collection ($n=1$; described below).

The sample consisted of 93 cannabis users (34.4% female) aged 18–36 years ($M=20.95$, $SD=2.62$). The racial/ethnic composition was: 57.1% non-Hispanic Caucasian, 24.2% African American or Black, 3.3% Hispanic Caucasian, 1.1% American Indian, 1.1% Asian, 9.9% multiracial, and 3.3% other. The majority (81.7%) were college students with 14.3% employed full-time and 40.7% employed part-time. Mean age of first cannabis use was 15.97 ($SD=2.06$; range = 11–20). At baseline, participants reported using cannabis 7–90 ($M=70.0$, $SD=20.0$) days in the past 90 days. All participants endorsed at least weekly past-month use (with 81.4% endorsing daily use) and 68.8% met DSM-IV-TR criteria for cannabis dependence and 18.3% met criteria for cannabis abuse. Per DSM-IV-TR (APA, 2000), respondents meeting criteria for both abuse and dependence were classified as dependence only. Criteria for a cannabis dependence were consistent with DSM-IV (APA, 2000) with the addition of withdrawal as proposed for DSM-5 (APA, 2013). The majority (94.6%) met DSM-IV criteria for an Axis I disorder and 58.1% met criteria for at least two disorders. Primary diagnoses included cannabis dependence (48.9%), social anxiety disorder (19.6%), cannabis abuse (8.7%), alcohol use disorder (7.6%), depressive disorder (3.3%), generalized anxiety disorder (2.2%), PTSD (1.1%), and specific phobia (1.1%).

2.2. Baseline measures

Diagnoses were determined via the *Structured Clinical Interview for DSM Disorders* (First et al., 2007) administered by trained clinical psychology graduate students and reviewed with a licensed clinical psychologist. Diagnostic reliability of primary CUD diagnoses was established by comparing original diagnoses with diagnoses made for a randomly selected 20% of the sample by trained students blind to initial diagnoses. Percent agreement was 92.3%.

Frequency of cannabis use during the 90 days prior to baseline was assessed with the *Timeline Follow Back* (Sobell and Sobell, 1996). Participants reported for each day how many cigarette-sized joints of cannabis they used. This measure has demonstrated good psychometrics (Fals-Stewart et al., 2000).

2.3. EMA measures

EMA assessments were completed on a personal desk assistant (PDA) using Satellite Forms 5.2 by Pumattech. Three types of assessments were collected from all participants (Wheeler and Reis, 1991): *signal contingent* (in response to a signal from the PDA at six semi-random times within 20 min of the following anchor times: 9:20am, 11:40am, 1:00pm, 3:20pm, 5:40pm, and 7:20pm), *interval contingent* (at bedtime), and *event contingent* (immediately prior to using cannabis). The same questions were presented regardless of assessment type.

Marijuana Withdrawal Checklist (Budney et al., 2003) assessed 15 withdrawal symptoms during participants’ most recent period of abstinence from 0 (*not at all*) to 3 (*severe*). This measure has been successfully adapted for use in EMA, with good internal consistency (Buckner et al., 2013). Internal consistency in the current sample was good ($\alpha=.87$).

Momentary cannabis craving was rated from 0 (*no urge*) to 10 (*extreme urge*) as in prior EMA work (Buckner et al., 2012a, 2013). This scale strongly correlated with the four factors of *Marijuana Craving Questionnaire* (Heishman et al., 2001) in prior work (Buckner et al., 2011).

Positive and Negative Affect Scale (Watson et al., 1988) consists of the positive and negative affect subscales each consisting of 10 emotions. Participants rated each emotion felt in the moment from 1 (*very slightly or not at all*) to 5 (*extremely*). Scales have achieved acceptable internal consistency in EMA work (Buckner et al., 2013). Internal consistency in the current sample was excellent (negative affect $\alpha=.91$, positive affect $\alpha=.94$).

Marijuana Motives Measure (MMM; Simons et al., 1998) was modified such that participants checked a box next to each of 25 items that corresponded with their reason for using cannabis during use episodes (as per Buckner et al., 2013). The MMM has demonstrated good psychometrics (e.g., Zvolensky et al., 2007).

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