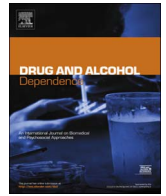




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# Drug and Alcohol Dependence

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Full length article

## Development and initial validation of a marijuana cessation expectancies questionnaire

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### ABSTRACT

**Background:** The present research examines anticipated consequences of ceasing or reducing marijuana use with initial development and psychometric validation of a measure of marijuana cessation expectancies.

**Methods:** The 46-item Marijuana Cessation Expectancies Questionnaire (MCEQ) was initially developed from the content validity analysis of free responses about expected outcomes of stopping and decreasing marijuana use generated by 94 participants. The closed-ended MCEQ was subsequently administered to 151 non-treatment seeking regular marijuana users (used on  $M = 64.7\%$  of the prior 60 days,  $SD = 25.1\%$ ;  $M_{age} = 21.4$ ,  $SD = 3.96$ ; 38.4% female).

**Results:** Exploratory factor analyses identified six MCEQ factors that accounted for 61% of variance, which were related to expected improvement in: 1) performance/motivation, 2) problems with authority, and 3) interpersonal functioning, and expected worsening of 4) mood states and 5) fun experiences, and 6) changes in appetite/weight from cessation/reduction of marijuana use. Internal consistency of full scale items was good ( $\alpha = 0.86$ ) and moderate to high for all factors ( $\alpha$ 's = 0.60–0.89). The MCEQ items showed good concurrent validity with key measures and incremental associations with change indices (prior history of cessation/reduction attempt, benefits of reduction, importance of change), beyond the effects of marijuana use expectancies.

**Conclusions:** These data provide initial support for the MCEQ and suggest it is closely linked to reduction/cessation decisions in marijuana users. MCEQ may be used clinically to enhance existing behavioral treatments and motivational interventions for problem marijuana use.

### 1. Introduction

Marijuana is the most prevalent psychoactive drug used in the world (Substance Abuse and Mental Health Services Administration, 2014). Although most individuals with cannabis use disorder (CUD) do not seek formal treatment (Stinson et al., 2006), during the 10-year period spanning 1999–2009, demand for CUD treatment in the U.S. increased by 72% (Substance Abuse and Mental Health Services Administration, 2010). Marijuana users in treatment report more than six prior serious attempts at quitting (Budney et al., 2007), and this number is likely higher among users who attempt to cease or reduce use on their own, without formal treatment (Copersino et al., 2006; Ellingstad et al., 2006; Hughes et al., 2008; Swift et al., 2000; Weiner et al., 1999). Despite widespread and increasing prevalence of marijuana use, little research has examined marijuana self-change processes and the role of

marijuana expectancies related to reduction/cessation of use.

Alcohol and drug outcome expectancies are cognitive representations of learning processes reflecting positively and negatively valenced effects of substances (Abrams and Niaura, 1987; Goldman et al., 1991). Expectancies about the effects of substance use play a major role in the initiation, maintenance, and escalation of substance use (Brown et al., 1987; Cooper, 1994) and are implicated in relapse and abstinence (Marlatt and Donovan, 2005; Metrik and Rohsenow, 2013; Trudeau et al., 2003). For example, expecting positive outcome effects from marijuana use has been associated with marijuana relapse during a self-initiated cessation attempt (Boden et al., 2013) and greater frequency of marijuana use (Galen and Henderson, 1999; Hayaki et al., 2010). Conversely, higher negative marijuana outcome expectancies have been prospectively linked with cessation from marijuana (Aarons et al., 2001) and are associated with indices of problem use (Buckner and

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Schmidt, 2008) and cannabis dependence severity (Connor et al., 2011).

A related yet distinct construct is expectancies of cessation, which represents the cognitive processes underlying motivation to reduce or stop substance use. For example, expectations regarding the anticipated outcomes of ceasing or decreasing alcohol use influence decisions to stop or reduce drinking (Metrik et al., 2004), with heavy drinkers endorsing more negative short-term consequences of stopping or limiting one's alcohol consumption (Metrik et al., 2004). Alcohol cessation expectancies are inversely associated with positive alcohol use expectancies among adolescents (Anderson et al., 2011) and are shown to predict future interest in reducing alcohol use and past month quit attempts (Bekman et al., 2011). Similarly, negative tobacco smoking abstinence expectancies are associated with higher levels of tobacco dependence (Hendricks et al., 2011) and more severe nicotine withdrawal symptoms (Hendricks and Leventhal, 2013). Thus, cessation expectancies are useful in understanding efforts by individuals to reduce or stop their use of substances, and more broadly, in explicating mechanisms of behavior change.

Expectations regarding the reduction or cessation of marijuana use have not yet been investigated. Expectancy about the consequence of an action (e.g., cessation of substance use) broadly underlies one's motivation for the behavioral change (Bandura, 1977). An expectancy of a negative outcome from marijuana cessation (e.g., isolation from friends who continue to use marijuana) may serve to demotivate an actual quit attempt and will likely be more closely linked with the purposeful effort to change marijuana relative to other marijuana-related cognitions. Conversely, a positive cessation expectancy of improvement in memory functioning may actually facilitate making a decision to stop using marijuana. Thus, a measure of marijuana cessation expectancy that helps to identify the anticipated negative and positive outcomes of reducing or quitting marijuana use may help facilitate the clinical treatment process among heavy or dependent marijuana users and among marijuana users actively working towards reducing or stopping their use.

The *Marijuana Cessation Expectancy Questionnaire* (MCEQ) was developed in the present study to assess expectancies regarding cessation or reduction of marijuana use. The MCEQ was initially developed from responses to an open-ended questionnaire generated by participants as part of a marijuana assessment battery in an experimental study (Metrik et al., 2012). A free response format was used to personally identify outcomes of stopping and decreasing marijuana use (i.e., "In your opinion, what would change the most if you or someone your age cut down [stopped] using marijuana?"). The decision to include beliefs about cessation or reduction of marijuana use was motivated by the observation that reduction and cessation are common outcomes among marijuana users who attempt to change their behavior (Hughes et al., 2016, 2008). The closed-ended MCEQ was subsequently developed from the content validity analysis (Haynes et al., 1995) of these free response data, yielding 46 items to measure expectancies about cessation and/or reduction of marijuana use. The present study aimed to provide an initial test of the psychometric properties of the MCEQ measure, among non-treatment seeking frequent marijuana users. The factor structure, descriptive characteristics, internal consistency, concurrent and incremental validity of the MCEQ were tested in relation to marijuana use and cessation of use. Specifically, we expected that the MCEQ dimensions would be significantly associated with: 1) indicators of marijuana use and of problematic marijuana use, 2) another related, yet distinct construct (i.e., marijuana use expectancies), and 3) indices of marijuana change behavior (i.e., marijuana change attempts and benefits and importance of change), and that MCEQ dimensions (relative to marijuana use expectancies) would be uniquely related to marijuana change behavior.

## 2. Methods

### 2.1. Participants and procedures

Data were used from the baseline sessions of two independent laboratory marijuana-administration studies (Metrik et al., 2015, 2012). In the first study (Metrik et al., 2012), the first 94 participants generated a list of expected outcomes of stopping and decreasing marijuana use in an open-ended format. An expectancy measure was created from these answers and administered to a new sample of 47 participants in the same study and to 104 participants in the second study (Metrik et al., 2015). The procedure for collection of the closed-ended marijuana expectancy data was identical, and therefore data were combined from the two samples. Thus, a total of 151 non-treatment seeking frequent marijuana users, recruited from the community through newspaper advertisements, flyers, and social media websites, were included in the validation of the marijuana cessation expectancy measure. In the first study (Metrik et al., 2012), participants were between 18 to 30 years of age and reported using marijuana at least once per week in the past month and at least 10 times in the past 6 months but not more than 6 days per week. In the second study (Metrik et al., 2015), participants were between 18 to 44 years of age and reported marijuana use at least 2 days per week in the past month and at least weekly in the past 6 months. Participants were excluded from both studies if they reported intent to quit or receive treatment for cannabis use at study screening, past-month affective disorder or panic attacks, psychotic symptoms, or suicidal state; DSM-IV alcohol dependence (Study 1 only); positive urine toxicology screen for drugs other than marijuana; pregnancy; nursing; and smoking 20 or more tobacco cigarettes per day. Participants completed self-report measures during each study. Participants ( $n = 151$ ;  $M_{age} = 21.4$ ,  $SD = 3.96$ ; 38.4% female) identified race as Caucasian (86.8%), African-American (4.0%), Asian (3.3%), or multiracial/other (5.9%); 13.2% identified ethnicity as Hispanic/Latino. The majority of participants were in college (69.5%). Participants reported alcohol use on 25.0% ( $SD = 18.34$ ) of days during the past 60 days, and 47.0% reported any tobacco use in the past 60 days. Both study protocols were approved by the Brown University Institutional Review Board.

### 2.2. Measures

#### 2.2.1. Marijuana cessation expectancies scale

(MCEQ). This closed-ended questionnaire uses a 5-point forced choice format ( $-2 =$  a lot worse;  $-1 =$  worse;  $0 =$  no difference;  $1 =$  better,  $2 =$  a lot better) prompting to answer the question: "How would each of the following change if you cut down or stopped using marijuana?" Items were developed from the content analysis of free responses about expected outcomes of stopping and decreasing marijuana use. The 46 items were selected based on most prevalent participant-generated responses covering a broad range of experiences relevant to marijuana smokers including social effects (e.g., fitting in with others), academic performance, self-perception (e.g., self-respect), alternative reinforcers (e.g., money), internal reactions (e.g., feeling nervous), changes in mood (e.g., feeling happy), and physical changes (e.g., health).

#### 2.2.2. Marijuana effect expectancies questionnaire (MEEQ; Schafer and Brown, 1991)

Expectancies regarding marijuana were measured with the 48-item MEEQ. Mean composite scores were used for positive (Cronbach's  $\alpha = 0.78$ ) and negative (Cronbach's  $\alpha = 0.82$ ) subscales; full scale ( $\alpha = 0.81$ ).

#### 2.2.3. DSM-IV cannabis dependence symptoms (American Psychiatric Association, 2000)

The total sum (range: 0–7) of number of cannabis dependence

symptoms endorsed via a clinical diagnostic assessment (SCID-I/NP) by trained research assessors with a bachelors or masters degrees in psychology or related fields.

#### 2.2.4. Timeline follow-back calendar (TLFB; Dennis et al., 2004)

TLFB is a calendar-assisted structured interview administered by research assessors to record the percentage of days participants reported marijuana use during the 60 days prior to baseline.

#### 2.2.5. Marijuana problems scale (MPS; Stephens et al., 2000)

Marijuana-related problems (number and severity) experienced over the past 90 days were assessed with the 22-item MPS. Items endorsed as either minor or serious were summed to derive a total count of marijuana problems ( $\alpha = 0.77$ ).

#### 2.2.6. Marijuana craving (MCQ)

The MCQ is a 10-item self-report assessment of subjective marijuana craving completed by participants after a 15-h deprivation period. The MCQ is adapted from a tobacco-smoking urges questionnaire (Tiffany and Drobes, 1991) and validated for use with marijuana (Budney et al., 2003). Participants were asked to respond to items (rated on a 1 = “strongly disagree” to 7 = “strongly agree” scale) according to how they were thinking or feeling “right now,” with higher scores indicating greater subjective marijuana craving. Items were averaged to yield a total craving score (possible range 1–7; observed range 1–6). Internal consistency of the MCQ items was  $\alpha = 0.90$ .

#### 2.2.7. Marijuana change attempts

Marijuana Change Attempts were assessed as part of the *Marijuana History and Smoking Questionnaire* (Metrik et al., 2009). Participants were asked two questions about lifetime attempts to stop or cut down on their use of marijuana, “Have you ever tried to quit (or cut down) using marijuana? (yes/no)”. Because of the substantial overlap in the participants’ cessation and reduction attempts, the two questions were combined into a single composite score of lifetime marijuana change attempts used as a dichotomous variable.

#### 2.2.8. Perceived benefits of reducing marijuana use and motivation for change

Change-related measures were completed as part of a personalized feedback report ( $n = 134$ ). Participants checked off a list of benefits of reducing their marijuana use covering positive outcomes from reduced use. Scores were summed to yield a total count of benefits (possible range = 0–11; observed range = 0–10;  $\alpha = 0.66$ ). Participants also rated motivation to make changes in marijuana use: “How important is it to you to make changes in your marijuana use [0 = not at all to 10 = extremely]?”.

### 2.3. Data analysis plan

Descriptive statistics were first examined to characterize the sample in terms of marijuana use history and cessation/reduction attempts. Next, a series of tests were conducted to assess the psychometric properties of the MCEQ: (1) Because there were no a priori hypotheses regarding the underlying factor, an exploratory factor analysis (EFA) was conducted. Cessation and reduction expectancies were hypothesized to be correlated and factorially complex. Consequently, analyses were conducted using maximum likelihood factoring with oblique (promax) rotation (Fabrigar et al., 1999; Floyd and Widaman, 1995). To refine factors, maximally redundant items were eliminated from a factor if (a) factor loading on the primary factor was  $< 0.50$  and (b) item cross-loading on factors was greater than 0.20. (2) Cronbach’s alpha was used to document internal consistency of identified factors and the total MCEQ. (3) To evaluate concurrent validity, zero-order correlations were computed between the MCEQ subscales scores in relation to: marijuana use variables (number of cannabis dependence

symptoms, marijuana problems, craving severity), marijuana use outcome expectancies (per the MEEQ), and change-related variables (marijuana change attempts, number of benefits for reducing marijuana use, and importance of change). (4) Incremental validity was tested to examine the unique associations of MCEQ, relative to the MEEQ, with change-related processes by conducting multiple regression analyses (logistic regression for reduction/cessation attempts and linear regression for the other two change-related dependent variables) in which both scales were included in the model. The focus of these analyses was on increasing prediction of the target variables related to marijuana change with the measure of expectancies (i.e., the MCEQ) that are theoretically more closely linked with the change processes relative to marijuana use expectancies (i.e., the MEEQ).

## 3. Results

### 3.1. Marijuana use patterns and cessation history

On average, participants reported using marijuana 64.7% ( $SD = 25.1$ ) of days over the past 60 days prior to baseline (approximately 4.5 days per week). Participants reported using marijuana 2.0 ( $SD = 1.18$ ) times per day, and 37.1% of the sample reported regular use of marijuana prior to 17 years of age. Two-thirds of participants (65.6%) endorsed  $\geq 1$  cannabis dependence symptom (16% met DSM-IV criteria for cannabis dependence), and averaged 3.7 ( $SD = 3.02$ ) problems from marijuana use on the MPS in the past 90 days (range 0–16).

One quarter (26.5%) of the sample reported a past marijuana cessation attempt and half (51.0%) reported a past attempt to reduce marijuana use. Together, 57.6% of the individuals reported a past attempt to change their marijuana use behavior. Participants who reported change attempts, relative to those without, had significantly more marijuana use problems on the MPS ( $M = 4.6$ ,  $SD = 3.22$  versus  $M = 2.5$ ,  $SD = 2.21$ ;  $t(148.4) = 4.86$ ,  $p < 0.0001$ ), more cannabis dependence symptoms ( $M = 1.5$ ,  $SD = 1.44$  versus  $M = 0.9$ ,  $SD = 1.00$ ;  $t(148.6) = 3.24$ ,  $p = 0.001$ ), and reported more frequent marijuana use on the TLFB (68.8% use days versus 59.3% use days;  $t(149) = -2.33$ ,  $p = 0.021$ ). Participants reported overall low average importance of making changes in marijuana use ( $M = 2.51$ ,  $SD = 2.43$ ; observed range 0–8). The most commonly reported perceived benefits of reducing marijuana use were: having more money (71.5%), being healthier (59.6%), and being more productive (40.4%).

### 3.2. Exploratory factor analyses

Twelve correlated expectancy factors were extracted from the initial factor analysis on the basis of scree plot, eigenvalues  $> 1.0$ , and proportion of common variance accounted (Floyd and Widaman, 1995). The factor structure accounted for 65.39% of the common variance. Based on the *a priori* criteria, 22 items were eliminated due to low factor loadings and/or multiple cross-loadings. In the final factor analysis, 6 correlated expectancy factors were extracted on the basis of scree plot, eigenvalues  $> 1.0$ . Overall, the six-factor structure accounted for 61.50% of the common variance. Based on items with the highest factor loadings, these expectancy factors were labeled as follows: Expectancies of changes in (a) *Performance and Motivation* (memory, motivation; 10 items); (b) *Mood States* (5 items), (c) *Appetite/Eating Behavior* (2 items), (d) *Problems with Authority* (2 items), (e) *Interpersonal Relationships* (3 items) and (f) *Fun Experiences* (2 items). See Table 1 for list of item loadings across factors. Based on the factor analytic findings, the 24 items corresponding with each factor were averaged to derive six MCEQ mean composite scores.

### 3.3. Descriptive characteristics of MCEQ

The means and standard deviations for the MCEQ subscale scores,

**Table 1**  
Factor Loadings from Exploratory Factor Analysis.  
5.19  
5.52

MCEQ Items	Factor Loadings					
	Performance/ Motivation	Mood States	Appetite/ Eating	Problems with Authority	Interpersonal Relationships	Fun Experiences
1. Hanging out with non-(marijuana) smokers	0.147	−0.084	0.015	0.009	<b>0.576</b>	−0.116
2. Having fun	−0.050	−0.022	0.054	0.036	0.086	<b>0.784</b>
3. Getting in trouble with parents or authority figures	−0.078	−0.124	−0.051	<b>0.521</b>	0.125	0.047
4. Feeling stressed	−0.103	<b>0.611</b>	0.073	−0.121	−0.071	0.138
5. Respect from others	0.006	0.120	−0.112	−0.013	<b>0.528</b>	0.096
6. Ability to concentrate and maintain focus	<b>0.630</b>	0.095	−0.005	−0.062	0.015	−0.192
7. Being productive, accomplishing tasks	<b>0.640</b>	−0.027	0.024	−0.053	0.157	−0.125
8. Dating	−0.012	0.098	0.028	0.002	<b>0.589</b>	0.015
9. Energy level	<b>0.801</b>	−0.052	0.049	0.016	−0.093	0.028
10. Motivation	<b>0.923</b>	−0.027	−0.016	−0.090	−0.163	0.129
11. Anxiety or worry	0.005	<b>0.917</b>	−0.021	−0.052	0.009	−0.108
12. Mood	0.085	<b>0.754</b>	−0.017	−0.062	0.001	0.008
13. Feeling left out or lonely	−0.113	<b>0.544</b>	0.068	0.150	0.083	0.155
14. Being involved in new activities or interests	<b>.510</b>	0.115	0.019	0.029	0.148	0.064
15. Getting in trouble with the law	0.074	0.098	0.025	<b>0.986</b>	−0.122	−0.061
16. Appetite	−0.008	0.137	<b>0.541</b>	−0.007	−0.092	0.000
17. Eating habits	0.016	−0.068	<b>1.006</b>	−0.020	0.037	−0.007
18. Physical activity/exercise	<b>0.588</b>	−0.056	0.012	0.016	0.172	0.118
19. Lung functioning/capacity	<b>0.527</b>	−0.127	−0.061	0.154	0.020	0.099
20. Memory	<b>0.618</b>	0.006	−0.033	0.026	−0.008	−0.143
21. Headaches	0.079	<b>0.517</b>	−0.021	0.115	0.119	−0.033
22. Feeling tired	<b>0.613</b>	0.088	0.101	0.007	0.023	−0.003
23. Staying organized	<b>0.653</b>	0.003	−0.067	−0.006	−0.014	0.104
24. Parties	0.107	0.123	−0.073	−0.060	−0.111	<b>0.538</b>
<b>% Variance explained by factor</b>	25.58	12.59	6.42	6.19		

Note. Significant factor loadings (> 0.5) are shown in boldface type.

**Table 2**  
Descriptive Statistics, Internal Consistency and Inter-Subscale Correlations.  
**0.60**

MCEQ Subscales	1.	2.	3.	4.	5.	6.
Factor 1: Performance/ Motivation	<b>0.89</b>	0.25**	0.09	0.18*	0.44**	0.11
Factor 2: Mood States		<b>0.82</b>	0.22**	−0.03	0.31**	0.33**
Factor 3: Appetite/Eating			<b>0.71</b>	−0.01	0.09	0.10
Factor 4: Problems with Authority				<b>0.65</b>	0.10	−0.07
Factor 5: Interpersonal Relationships					<b>0.60</b>	0.13
Factor 6: Fun Experiences						
<b>Mean</b>	0.54	−0.24	0.06	0.25	0.23	−0.23
<b>SD</b>	0.44	0.49	0.66	0.46	0.37	0.51

Note. \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; Diagonal includes Cronbach's alpha (bolded). Mean composite scores were used for the six MCEQ subscales. A mean score of 0 indicates expectancy that there will be no difference following marijuana reduction/cessation; positive scores indicate improvement following marijuana reduction/cessation and negative scores indicated worsening following marijuana reduction/cessation.

and their inter-correlations, are presented in Table 2. As illustrated in Fig. 1, on average, participants expected greatest improvement in performance/motivation from marijuana reduction/cessation, and modest improvement in problems with authority and interpersonal interactions. In contrast, on average, participants expected a worsening of mood states and fun experiences. Scores on the appetite/eating behavior subscale reflected that, on average, participants expected no change from marijuana reduction/cessation.

### 3.4. Internal consistency

The overall internal consistency of MCEQ items was  $\alpha = 0.86$ . Cronbach's alpha did not change with removal of any single item (total  $\alpha$  range = 0.850–.868). The subscale items exhibited moderate to high internal consistency as well ( $\alpha$ 's = 0.60–0.89; see Table 2).

### 3.5. Concurrent validity

See Table 3 for concurrent validity results. Regarding domains that were expected to improve following marijuana cessation/reduction, MCEQ-Performance/Motivation was associated with more cannabis dependence symptoms and marijuana problems on the MPS, and MCEQ-Problems with Authority and MCEQ-Interpersonal Relationships were significantly positively associated with marijuana problems on the MPS. Regarding domains that were expected to worsen following marijuana cessation/reduction (lower scores on the MCEQ), MCEQ-Mood States was associated with more frequent marijuana use and more severe craving after overnight deprivation, and MCEQ-Fun Experiences was not significantly associated with marijuana use variables. Expectancies of worsening of appetite/eating (lower MCEQ-Appetite/Eating scores) were associated with more severe marijuana craving on the MCQ.

Overall, the three negative MEEQ expectancy subscales were positively correlated with domains that were expected to improve upon cessation/reduction (MCEQ-Performance/Motivation and MCEQ-Interpersonal Relationships), whereas the three positive MEEQ expectancy subscales were negatively associated with domains that were expected to worsen from cessation/reduction (MCEQ-Mood States and MCEQ-Fun Experiences).

In terms of change-related variables, two domains that were expected to improve from marijuana cessation/reduction (MCEQ

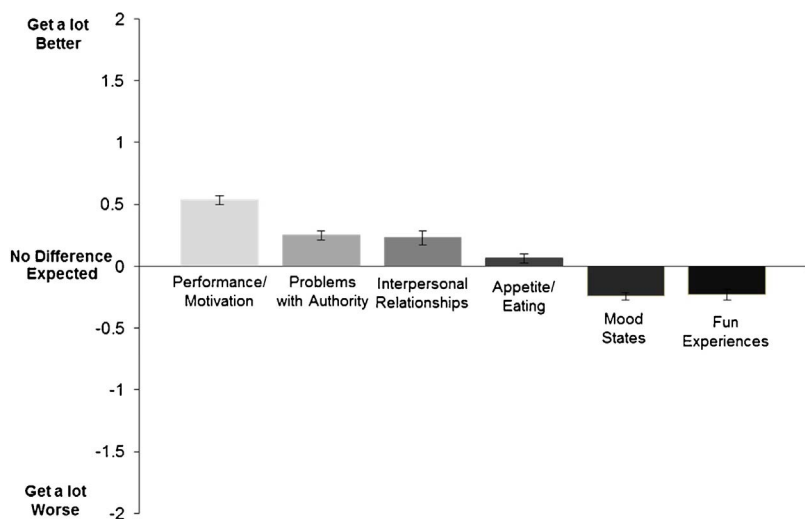


Fig. 1. Visual depiction of means and standard errors for MCEQ subscales. A score of 0 indicates expectancy that there will be no difference following marijuana reduction/cessation. Bars represent standard error. Positive MCEQ subscales = Performance/Motivation, Problems with Authority, Interpersonal Relationships, Appetite/Eating (improvement expected from marijuana reduction/cessation); Negative MCEQ subscales = Mood States, Fun Experiences (worsening expected from marijuana reduction/cessation).

Performance/Motivation, Interpersonal Relationships) were significantly associated with marijuana change attempts (cessation or reduction), greater perceived benefits from reducing marijuana use, and greater importance of change rating. MCEQ-Problems with Authority was not associated with any marijuana change-related processes. Additionally, domains that were expected to worsen from marijuana cessation/reduction were not associated with marijuana-change processes with the exception of MCEQ-Mood states, which was positively associated with importance of change.

3.6. Incremental validity

Next, we examined the associations of the positive and negative MCEQ subscales with change-related processes (marijuana change attempts, number of benefits for reducing marijuana use, and importance of change), relative to the effects of positive and negative marijuana use expectancies (MEEQ). See Table 4 for results. Mean composite scores were derived from the positive MCEQ subscales (Performance/Motivation, Problems with Authority, Interpersonal Relationships) and negative MCEQ subscales (Mood States, Fun Experiences). In the first

Table 3  
Concurrent Validity.

Cannabis Use Variables	MCEQ Subscales					
	MCEQ Positive Expectancies <sup>a</sup>			MCEQ Negative Expectancies <sup>b</sup>		
	Performance/Motivation	Problems with Authority	Interpersonal Relationships	Mood States	Fun Experiences	Appetite/Eating
DSM-IV Cannabis Dependence Symptoms	0.34**	0.09	0.16	-0.01	-0.03	-0.01
TLFB Percent Marijuana Use Days	-0.05	0.12	0.06	-0.22**	-0.02	-0.12
Marijuana Problems (MPS)	0.58**	0.17*	0.30**	-0.04	0.04	0.09
Marijuana Craving (MCQ)	0.07	0.01	-0.03	-0.30**	-0.16	-0.21**
<b>MEEQ Marijuana Use Expectancies</b>	<b>Performance/Motivation</b>	<b>Problems with Authority</b>	<b>Interpersonal Relationships</b>	<b>Mood States</b>	<b>Fun Experiences</b>	<b>Appetite/Eating</b>
<b>MEEQ Positive Expectancies</b>						
Perceptual/Cognitive Enhancement	0.09	0.14	0.01	-0.31**	-0.24**	-0.14
Relaxation/Tension Reduction	0.03	0.17*	-0.06	-0.37**	-0.27**	-0.07
Social/Sexual Facilitation	-0.15	0.19*	-0.13	-0.32**	-0.45**	-0.03
<b>MEEQ Negative Expectancies</b>						
Cognitive/Behavioral Impairment	0.40**	0.02	0.17*	0.05	-0.09	0.05
Negative Effects	0.39**	0.06	0.32**	0.35**	0.10	0.08
Craving/Physical Effects	0.22**	-0.09	0.08	-0.14	-0.14	0.07
<b>Cessation-Related Processes</b>	<b>Performance/Motivation</b>	<b>Problems with Authority</b>	<b>Interpersonal Relationships</b>	<b>Mood States</b>	<b>Fun Experiences</b>	<b>Appetite/Eating</b>
Lifetime Change Attempt (Yes) <sup>c</sup>	0.18*	0.05	0.17*	0.03	0.12	-0.01
Benefits of Reduction <sup>d</sup>	0.48**	0.05	0.36**	0.12	0.11	-0.06
Importance of Change <sup>d</sup>	0.30**	-0.07	0.41**	0.18*	0.11	0.14

Note. \* p < 0.05; \*\* p < 0.01.

TLFB = Timeline Follow-Back calendar; MPS = marijuana problems scale; MCQ = marijuana craving questionnaire; MEEQ = marijuana effect expectancies questionnaire; MCEQ = Marijuana Cessation Expectancies Questionnaire

<sup>a</sup>Positive MCEQ subscales reflect domains in which improvement is expected following marijuana reduction/cessation.

<sup>b</sup>Negative MCEQ subscales reflect domains that are expected to worsen following marijuana reduction/cessation.

<sup>c</sup>Lifetime Change Attempt = History of any attempt to reduce or stop marijuana use (yes/no).

<sup>d</sup>n = 134 for Benefits of reduction and Importance of change of marijuana use.



**Table 4**  
Incremental Validity.

	Change Attempts <i>OR (CI<sub>95%</sub>)</i>	Benefits of Reduction <sup>a</sup> <i>B (CI<sub>95%</sub>)</i>	Importance of Change <sup>a</sup> <i>B (CI<sub>95%</sub>)</i>
<b>Positive Expectancies</b>			
MCEQ-Positive	<b>4.07</b> (1.20–13.80)*	<b>3.00</b> (1.85–4.15)***	<b>2.35</b> (1.05–3.66)***
MEEQ-Positive	0.75 (0.35–1.60)	–0.23 (–1.04–0.58)	–0.77 (–1.68–0.15)
<b>Negative Expectancies</b>			
MCEQ-Negative	1.58 (0.69–3.64)	0.69 (–0.20–1.57)	<b>1.01 (0.02–1.99)*</b>
MEEQ-Negative	2.07 (0.93–4.60)	<b>1.43</b> (0.58–2.29)**	0.73 (–0.23–1.68)

Note. \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

MCEQ = Marijuana Cessation Expectancies Questionnaire.

MEEQ = Marijuana Expectancies Effects Questionnaires.

<sup>a</sup>  $n = 134$  for Benefits of Reduction and Importance of Change.

models predicting the three dependent variables, the MCEQ-Positive score was simultaneously entered with the MEEQ-Positive subscale. In the second models predicting the three dependent variables, the MCEQ-Negative score was entered simultaneously with the MEEQ-Negative subscale.

**Positive MCEQ and MEEQ Expectancies.** Multivariate logistic regression results indicated that the model with positive expectancies predicting likelihood of making a lifetime marijuana cessation/reduction attempt ( $\chi^2(2) = 5.92, p = 0.052$ ) was driven by the effect of MCEQ-Positive score ( $\chi^2(1) = 5.08, OR = 4.07, p = 0.024$ ); the effect of MEEQ-Positive subscale was non-significant ( $\chi^2(1) = 0.57, OR = 0.75, p = 0.452$ ). Results from the multiple regression model predicting benefits of marijuana reduction was significant ( $F(2,131) = 13.25, R^2 = 0.168, p < 0.0001$ ), which was driven by the significant effect of MCEQ-Positive score ( $B = 3.00, SE = 0.58, t = 5.14, p < 0.001; sr^2 = 0.168$ ); the effect of MEEQ-Positive subscale was non-significant ( $B = -0.23, SE = 0.41, t = -0.55, p = 0.582; sr^2 = 0.002$ ). Similarly, the model predicting importance of change was significant ( $F(2,131) = 7.42, R^2 = 0.102, p = 0.001$ ), which was driven by the significant effect of MCEQ-Positive score ( $B = 2.35, SE = 0.66, t = 3.58, p < 0.001; sr^2 = 0.088$ ); the MEEQ positive subscale was non-significant ( $B = -0.77, SE = 0.46, t = -1.66, p = 0.100; sr^2 = 0.019$ ).

**Negative MCEQ and MEEQ Expectancies.** The negative expectancies logistic regression model predicting likelihood of a lifetime cessation/reduction attempt was non-significant ( $\chi^2(2) = 4.53, p = 0.104$ ). The multiple regression model predicting benefits of marijuana reduction was significant ( $F(2,131) = 6.82, R^2 = 0.094, p = 0.002$ ); MEEQ-Negative was a significant predictor ( $B = 1.43, SE = 0.43, t = 3.31, p = 0.001; sr^2 = 0.076$ ) relative to the non-significant effect of MCEQ-Negative score ( $B = -0.69, SE = 0.45, t = 1.53, p = 0.129; sr^2 = 0.016$ ). The model predicting importance of change was significant ( $F(2,131) = 3.28, R^2 = 0.048, p = 0.041$ ), which was due to the significant effect of MCEQ-Negative score ( $B = 1.01, SE = 0.50, t = 2.02, p = 0.046; sr^2 = 0.030$ ); the effect of MEEQ-Negative subscale was non-significant ( $B = 0.73, SE = 0.48, t = 1.50, p = 0.135; sr^2 = 0.016$ ).

#### 4. Discussion

The primary goals of this study were to examine the psychometric properties of a new measure of marijuana cessation expectancies and its relation to marijuana change attempts and motivational aspects of marijuana change behavior. Unique domains of reduction and cessation effects on the MCEQ were identified: 1) improvement in: Performance/Motivation, Problems with Authority, and Interpersonal Relationships; and 2) expectancies of worse Mood States and Fun Experiences; with no substantial change in Appetite/Eating Behavior. These findings provide

initial clarification regarding cognitions about reducing/stopping marijuana use that generally are expected to improve or worsen from reduction/cessation of use. Consistent with existing substance use cessation expectancies measures (e.g., in tobacco; Hendricks et al., 2011), MCEQ items and subscales reflect negative and positive outcomes from cessation.

Anticipation of improvement in performance/motivation and interpersonal relationships was significantly associated with change behavior history, more beliefs about benefits of reduction, and greater importance for changing marijuana use. In contrast, no other MCEQ subscale score was consistently associated with change behavior indices. Thus, more salient beliefs that reducing/stopping marijuana use will result in improvements in (a) personal effectiveness and domains of motivation, executive functioning, and energy levels and (b) interpersonal relationships, are most strongly related to change behavior. Importantly, this expectancy set reflects the adverse effects of marijuana on neuropsychological functioning (Volkow et al., 2016), which may be most salient for marijuana users.

Domains that were expected to improve from marijuana cessation/reduction (MCEQ-Positive) were incrementally associated with past history of attempts to change marijuana use, reduction benefits, and importance of change, beyond the effects of positive marijuana use expectancies (per the MEEQ). The observed effects of the MCEQ were medium to large in size. A less consistent pattern of effects was observed for domains that were expected to worsen (MCEQ-Negative), suggesting that positive cessation expectancies may be stronger predictors of change behavior. This patterning of effects has been reported in the alcohol literature where abstinence (non-drinking) expectancies, but not alcohol use expectancies, were associated with purposeful efforts to change drinking among heavy-drinking youth (Bekman et al., 2011). Stronger negative marijuana use expectancies were incrementally associated with greater number of benefits of reduction, beyond the effects of MCEQ-Negative scores, consistent with prior findings on the association between negative marijuana use expectancies and marijuana non-use (Aarons et al., 2001).

We also documented concurrent associations between MCEQ subscale scores and measures of marijuana use/dependence and expectancies. Marijuana users reporting more existing marijuana-related problems or dependence symptoms may also hold stronger cessation expectancies related to improvements in performance/motivation, problems with authority, and interpersonal functioning. Similarly, stronger expectancies of worsening mood states upon reducing/stopping marijuana use were associated with more frequent marijuana use and greater craving after overnight deprivation. Consistent with prior alcohol literature (Anderson et al., 2011) and in support of concurrent associations, expectancies of positive outcome effects were negatively associated cessation expectancies that were believed to worsen (e.g., mood states and fun experiences), whereas negative marijuana use expectancies were positively associated with cessation expectancies believed to improve (performance/motivation, interpersonal relationships).

The results of the EFA clearly differentiated between anticipated negative consequences from quitting marijuana on fun experiences and anticipated positive consequences from quitting on improved interpersonal relationships and increased sober social supports. Having family and friend networks or significant others (McCrady et al., 2009; Monti et al., 2014) that are supportive of reduction in use is predictive of successful change (Longabaugh et al., 1995; Stout et al., 2012). In fact, positive social influence to quit marijuana is one of the predominant reasons among successful quitters (Ellingstad et al., 2006). The current findings provide evidence of personal salience of social influence in de-escalation from marijuana use and provide additional support to prior clinical research findings on social support being effectively incorporated into cannabis-specific interventions (Berghuis et al., 2006; Sobell et al., 2006; Walker et al., 2011).

Importantly, in this non-clinical sample, about one quarter of

marijuana users reported purposeful attempts to stop using and over half reported reduction attempts, attesting to the fact that many individuals make behavioral change attempts without formal treatment (Sobell et al., 2000; Stea et al., 2015). Assessment of marijuana cessation expectancies allows for a more nuanced understanding of cognitions that may either facilitate or inhibit behavioral change in an individual user. This could enhance motivational intervention approaches such as Guided Self-Change developed for use with problem cannabis users (Sobell et al., 2006).

Marijuana cessation expectancies may have greater utility in predicting marijuana change attempts for individuals in treatment for cannabis use disorder or those actively working towards cessation. It is possible that a more diversified MCEQ expectancy factor structure would emerge in such clinical populations relative to individuals without any history of marijuana quit attempts. Furthermore, specific types of positive cessation expectancies such as temporally-distal rather than proximal anticipated benefits of cessation may be better predictors of long-term cannabis treatment outcomes, as has been shown with alcohol expectancies with individuals in alcohol treatment (Jones and McMahon, 1994). Thus, testing performance of this measure in a clinical sample is warranted.

#### 4.1. Limitations

The current study has several limitations. The cross-sectional design limits causal inferences about the association between cessation expectancies and marijuana change attempts. Future studies designed to assess these variables at independent time points will help clarify the temporal sequencing of these relations and can examine cessation expectancy as a prospective predictor of de-escalation from marijuana use. The limited representation of items (2–3) for several of the MCEQ factors may have resulted in lower internal consistency reliability estimates, particularly for Fun Experiences, Interpersonal Relationships, and Problems with Authority subscales (Cronbach's alphas: 0.60–0.65). As the MCEQ measure is refined in future content validity analyses, adding highly reliable items may help clarify some of the broader constructs measured (e.g., interpersonal relationships) and should improve upon this initial measure development process. Finally, as the sample in the current study was predominantly Caucasian, results may not generalize to and should be replicated with racially diverse samples of marijuana users.

#### 4.2. Conclusions

This study is the first to examine expectancies concerning the anticipated consequences of active efforts to reduce or cease marijuana use. The MCEQ is related to marijuana use expectancies (e.g., per the MEEQ), yet appears to be more strongly associated with reports of previous quit/reduction attempts and with motivational aspects of marijuana change behavior. Motivation for change can be strengthened by helping individuals envision positive life changes via the assessment of benefits of reduced marijuana use. However, more comprehensive clinical assessment tools, such as the MCEQ, that allow for the exploration of anticipated positive and negative outcomes of stopping or reducing marijuana use can significantly enhance existing behavioral treatment for cannabis use disorder. Studies on marijuana cessation expectancy may guide new research investigating the role of these cognitive processes in cessation of problem marijuana use and intervention efforts to predict and motivate behavioral change in marijuana users.

#### Conflict of interest

All authors declare that they have no personal or financial conflict of interest.

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Dr. Metrik designed and conducted the studies from which these data were obtained. Drs. Metrik and Farris conducted the statistical analyses. Dr. Metrik wrote the manuscript and all authors contributed to the writing of the manuscript. All authors significantly contributed to and have approved the final manuscript. The authors gratefully acknowledge Suzanne Sales and Timothy Souza for their contribution to the project.

#### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.drugalcdep.2017.04.005>.

#### References

- Aarons, G.A., Brown, S.A., Stice, E., Coe, M.T., 2001. Psychometric evaluation of the marijuana and stimulant effect expectancy questionnaires. *Addict. Behav.* 26, 219–236. [http://dx.doi.org/10.1016/S0306-4603\(00\)00103-9](http://dx.doi.org/10.1016/S0306-4603(00)00103-9).
- Abrams, D.B., Niaura, R.S., 1987. Social learning theory. In: Blane, H.T., Leonard, K.E. (Eds.), *Psychological Theories of Drinking and Alcoholism*. Guilford Press, New York, pp. 131–178.
- American Psychiatric Association, 2000. *Diagnostic and Statistical Manual of Mental Disorders DSM-IV-TR Fourth Edition*, fourth ed. Amer Psychiatric Pub.
- Anderson, K.G., Grunwald, I., Bekman, N., Brown, S.A., Grant, A., 2011. To drink or not to drink: motives and expectancies for use and nonuse in adolescence. *Addict. Behav.* 36, 972–979. <http://dx.doi.org/10.1016/j.addbeh.2011.05.009>.
- Bandura, A., 1977. Self-efficacy: toward a unifying theory of behavioral change. *Psychol. Rev.* 84, 191–215.
- Bekman, N.M., Anderson, K.G., Trim, R.S., Metrik, J., Diulio, A.R., Myers, M.G., Brown, S.A., 2011. Thinking and drinking: alcohol-related cognitions across stages of adolescent alcohol involvement. *Psychol. Addict. Behav. J. Soc. Psychol. Addict. Behav.* 25, 415–425. <http://dx.doi.org/10.1037/a0023302>.
- Berghuis, J.P., Swift, W., Roffman, R.A., Stephens, R.S., Copeland, J., 2006. The teen cannabis check-up: exploring strategies for reaching young cannabis users. In: Roffman, R., Stephen, R. (Eds.), *Cannabis Dependence: Its Nature, Consequences, and Treatment*. Cambridge University Press, Cambridge, England.
- Boden, M.T., McKay, J.R., Long, W.R., Bonn-Miller, M.O., 2013. The effects of cannabis use expectancies on self-initiated cannabis cessation. *Addiction (Abingdon Engl.)* 108, 1649–1657. <http://dx.doi.org/10.1111/add.12233>.
- Brown, S.A., Christiansen, B.A., Goldman, M.S., 1987. The Alcohol Expectancy Questionnaire: an instrument for the assessment of adolescent and adult alcohol expectancies. *J. Stud. Alcohol* 48, 483–491.
- Buckner, J.D., Schmidt, N.B., 2008. Marijuana effect expectancies: relations to social anxiety and marijuana use problems. *Addict. Behav.* 33, 1477–1483. <http://dx.doi.org/10.1016/j.addbeh.2008.06.017>.
- Budney, A.J., Moore, B.A., Vandrey, R.G., Hughes, J.R., 2003. The time course and significance of cannabis withdrawal. *J. Abnorm. Psychol.* 112, 393–402. <http://dx.doi.org/10.1037/0021-843X.112.3.393>.
- Budney, A.J., Roffman, R., Stephens, R.S., Walker, D., 2007. Marijuana dependence and its treatment. *Addict. Sci. Clin. Pract.* 4, 4–16.
- Connor, J.P., Gullo, M.J., Feeney, G.F.X., Young, R.M., 2011. Validation of the Cannabis Expectancy Questionnaire (CEQ) in adult cannabis users in treatment. *Drug Alcohol Depend.* 115, 167–174. <http://dx.doi.org/10.1016/j.drugalcdep.2010.10.025>.
- Cooper, M.L., 1994. Motivations for alcohol use among adolescents: development and validation of a four-factor model. *Psychol. Assess.* 6, 117–128. <http://dx.doi.org/10.1037/1040-3590.6.2.117>.
- Copersino, M.L., Boyd, S.J., Tashkin, D.P., Huestis, M.A., Heishman, S.J., Derman, J.C., Simmons, M.S., Gorelick, D.A., 2006. Quitting among non-treatment-seeking marijuana users: reasons and changes in other substance use. *Am. J. Addict. Am. Acad. Psychiatr. Alcohol. Addict.* 15, 297–302. <http://dx.doi.org/10.1080/10550490600754341>.

- Dennis, M.L., Funk, R., Godley, S.H., Godley, M.D., Waldron, H., 2004. Cross-validation of the alcohol and cannabis use measures in the Global Appraisal of Individual Needs (GAIN) and Timeline Followback (TLFB; Form 90) among adolescents in substance abuse treatment. *Addiction* 99, 120–128. <http://dx.doi.org/10.1111/j.1360-0443.2004.00859.x>.
- Ellingstad, T.P., Sobell, L.C., Sobell, M.B., Eickelberry, L., Golden, C.J., 2006. Self-change: a pathway to cannabis abuse resolution. *Addict. Behav.* 31, 519–530. <http://dx.doi.org/10.1016/j.addbeh.2005.05.033>.
- Fabrigar, L.R., Wegener, D.T., MacCallum, R.C., Strahan, E.J., 1999. Evaluating the use of exploratory factor analysis in psychological research. *Psychol. Methods* 4, 272–299. <http://dx.doi.org/10.1037/1082-989X.4.3.272>.
- Floyd, F.J., Widaman, K.F., 1995. Factor analysis in the development and refinement of clinical assessment instruments. *Psychol. Assess.* 7, 286–299. <http://dx.doi.org/10.1037/1040-3590.7.3.286>.
- Galen, L.W., Henderson, M.J., 1999. Validation of cocaine and marijuana effect expectancies in a treatment setting. *Addict. Behav.* 24, 719–724.
- Goldman, M.S., Brown, S.A., Christiansen, B.A., Smith, G.T., 1991. Alcoholism and memory: broadening the scope of alcohol-expectancy research. *Psychol. Bull.* 110, 137–146. <http://dx.doi.org/10.1037/0033-2909.110.1.137>.
- Hayaki, J., Hagerly, C.E., Herman, D.S., de Dios, M.A., Anderson, B.J., Stein, M.D., 2010. Expectancies and marijuana use frequency and severity among young females. *Addict. Behav.* 35, 995–1000. <http://dx.doi.org/10.1016/j.addbeh.2010.06.017>.
- Haynes, S.N., Richard, D.C.S., Kubany, E.S., 1995. Content validity in psychological assessment: a functional approach to concepts and methods. *Psychol. Assess.* 7, 238–247. <http://dx.doi.org/10.1037/1040-3590.7.3.238>.
- Hendricks, P.S., Leventhal, A.M., 2013. Abstinence-related expectancies predict smoking withdrawal effects: implications for possible causal mechanisms. *Psychopharmacology (Berl.)* 230, 363–373. <http://dx.doi.org/10.1007/s00213-013-3169-7>.
- Hendricks, P.S., Wood, S.B., Baker, M.R., Delucchi, K.L., Hall, S.M., 2011. The smoking abstinence questionnaire: measurement of smokers' abstinence-related expectancies. *Addiction (Abingdon Engl.)* 106, 716–728. <http://dx.doi.org/10.1111/j.1360-0443.2010.03338.x>.
- Hughes, J.R., Peters, E.N., Callas, P.W., Budney, A.J., Livingston, A.E., 2008. Attempts to stop or reduce marijuana use in non-treatment seekers. *Drug Alcohol Depend.* 97, 180–184. <http://dx.doi.org/10.1016/j.drugalcdep.2008.03.031>.
- Hughes, J.R., Naud, S., Budney, A.J., Fingar, J.R., Callas, P.W., 2016. Attempts to stop or reduce daily cannabis use: an intensive natural history study. *Psychol. Addict. Behav. J. Soc. Psychol. Addict. Behav.* 30, 389–397. <http://dx.doi.org/10.1037/adb0000155>.
- Jones, B.T., McMahon, J., 1994. Negative alcohol expectancy predicts post-treatment abstinence survivorship: the whether, when and why of relapse to a first drink. *Addiction* 89, 1653–1665. <http://dx.doi.org/10.1111/j.1360-0443.1994.tb03766.x>.
- Longabaugh, R., Wirtz, P.W., Beattie, M.C., Noel, N., Stout, R., 1995. Matching treatment focus to patient social investment and support: 18-month follow-up results. *J. Consult. Clin. Psychol.* 63, 296–307.
- Marlatt, G.A., Donovan, D.D.M., 2005. *Relapse Prevention: Maintenance Strategies In The Treatment Of Addictive Behaviors*, 2nd ed. Guilford Press.
- McCready, B.S., Epstein, E.E., Cook, S., Jensen, N., Hildebrandt, T., 2009. A randomized trial of individual and couple behavioral alcohol treatment for women. *J. Consult. Clin. Psychol.* 77, 243–256. <http://dx.doi.org/10.1037/a0014686>.
- Metrik, J., Rohsenow, D.J., 2013. Understanding the role of substance expectancies in addiction. In: James Killip, Wit, de, H. (Eds.), *The Wiley-Blackwell Handbook of Addiction Psychopharmacology*. Wiley-Blackwell, pp. 459–487.
- Metrik, J., McCarthy, D.M., Frissell, K.C., MacPherson, L., Brown, S.A., 2004. Adolescent alcohol reduction and cessation expectancies. *J. Stud. Alcohol* 65, 217–226.
- Metrik, J., Rohsenow, D.J., Monti, P.M., McGeary, J., Cook, T.A.R., de Wit, H., Haney, M., Kahler, C.W., 2009. Effectiveness of a marijuana expectancy manipulation: piloting the balanced-placebo design for marijuana. *Exp. Clin. Psychopharmacol.* 17, 217–225. <http://dx.doi.org/10.1037/a0016502>.
- Metrik, J., Kahler, C.W., Reynolds, B., McGeary, J.E., Monti, P.M., Haney, M., de Wit, H., Rohsenow, D.J., 2012. Balanced placebo design with marijuana: pharmacological and expectancy effects on impulsivity and risk taking. *Psychopharmacology (Berl.)* 223, 489–499. <http://dx.doi.org/10.1007/s00213-012-2740-y>.
- Metrik, J., Aston, E.R., Kahler, C.W., Rohsenow, D.J., Knopik, V.S., 2015. Marijuana's acute effects on cognitive bias for affective and marijuana cues. *Exp. Clin. Psychopharmacol.* <http://dx.doi.org/10.1037/pha0000030>.
- Monti, P.M., Colby, S.M., Mastroleo, N.R., Barnett, N.P., Gwaltney, C.J., Apodaca, T.R., Rohsenow, D.J., Magill, M., Gogineni, A., Mello, M.J., Biffi, W.L., Cioffi, W.G., 2014. Individual versus significant-other-enhanced brief motivational intervention for alcohol in emergency care. *J. Consult. Clin. Psychol.* 82, 936–948. <http://dx.doi.org/10.1037/a0037658>.
- Schafer, J., Brown, S.A., 1991. Marijuana and cocaine effect expectancies and drug use patterns. *J. Consult. Clin. Psychol.* 59, 558–565. <http://dx.doi.org/10.1037/0022-006X.59.4.558>.
- Sobell, L.C., Ellingstad, T.P., Sobell, M.B., 2000. Natural recovery from alcohol and drug problems: methodological review of the research with suggestions for future directions. *Addiction (Abingdon Engl.)* 95, 749–764.
- Sobell, L.C., Wagner, E., Sobell, M.B., Agrawal, S., Ellingstad, T.P., 2006. Guided self-change: a brief motivational intervention for cannabis users. In: Roffman, R., Stephen, R. (Eds.), *Cannabis Dependence: Its Nature, Consequences, and Treatment*. Cambridge University Press, Cambridge, England.
- Stea, J.N., Yakovenko, I., Hodgins, D.C., 2015. Recovery from cannabis use disorders: abstinence versus moderation and treatment-assisted recovery versus natural recovery. *Psychol. Addict. Behav. J. Soc. Psychol. Addict. Behav.* 29, 522–531. <http://dx.doi.org/10.1037/adb0000097>.
- Stephens, R.S., Roffman, R.A., Curtin, L., 2000. Comparison of extended versus brief treatments for marijuana use. *J. Consult. Clin. Psychol.* 68, 898–908.
- Stinson, F.S., Ruan, W.J., Pickering, R., Grant, B.F., 2006. Cannabis use disorders in the USA: Prevalence, correlates and co-morbidity. *Psychol. Med.* 36, 1447–1460. <http://dx.doi.org/10.1017/S0033291706008361>.
- Stout, R.L., Kelly, J.F., Magill, M., Pagano, M.E., 2012. Association between social influences and drinking outcomes across three years. *J. Stud. Alcohol Drugs* 73, 489–497.
- Substance Abuse and Mental Health Services Administration, 2010. *Results from the 2009 National Survey on Drug Use and Health: Volume I. Summary of National Findings (No. HHS Publication No. SMA 10-4586)*, NSDUH Series H-38A. Office of Applied Studies, Rockville, MD.
- Substance Abuse and Mental Health Services Administration, 2014. *Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings (No. HHS Publication No. (SMA) 14-4863)*, NSDUH Series H-48. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Swift, W., Hall, W., Copeland, J., 2000. One year follow-up of cannabis dependence among long-term users in Sydney, Australia. *Drug Alcohol Depend.* 59, 309–318.
- Tiffany, S.T., Drobos, D.J., 1991. The development and initial validation of a questionnaire on smoking urges. *Br. J. Addict.* 86, 1467–1476.
- Trudeau, L., Spoth, R., Lillehoj, C., Redmond, C., Wickrama, K.A.S., 2003. Effects of a preventive intervention on adolescent substance use initiation, expectancies, and refusal intentions. *Prev. Sci. Off. J. Soc. Prev. Res.* 4, 109–122.
- Volkow, N.D., Swanson, J.M., Evins, A.E., DeLisi, L.E., Meier, M.H., Gonzalez, R., Bloomfield, M.A.P., Curran, H.V., Baler, R., 2016. Effects of cannabis use on human behavior, including cognition, motivation, and psychosis: a review. *JAMA Psychiatry* 73, 292–297. <http://dx.doi.org/10.1001/jamapsychiatry.2015.3278>.
- Walker, D.D., Stephens, R., Roffman, R., Demarco, J., Lozano, B., Towe, S., Berg, B., 2011. Randomized controlled trial of motivational enhancement therapy with nontreatment-seeking adolescent cannabis users: a further test of the teen marijuana check-up. *Psychol. Addict. Behav. J. Soc. Psychol. Addict. Behav.* 25, 474–484. <http://dx.doi.org/10.1037/a0024076>.
- Weiner, M.D., Sussman, S., McCuller, W.J., Lichtman, K., 1999. Factors in marijuana cessation among high-risk youth. *J. Drug Educ.* 29, 337–357.