HHS Public Access

Author manuscript

Drug Alcohol Depend. Author manuscript; available in PMC 2017 October 01.

Published in final edited form as:

Drug Alcohol Depend. 2016 October 1; 167: 175–181. doi:10.1016/j.drugalcdep.2016.08.018.

Change in Motives among Frequent Cannabis-Using Adolescents: Predicting Treatment Outcomes

Claire E. Blevins,
Virginia Tech, Blacksburg, VA, Warren Alpert Medical School at Brown University, Providence, RI, Butler Hospital, Providence, RI

Kelsey E. Banes,
Virginia Tech, Blacksburg, VA

Robert S. Stephens,
Virginia Tech, Blacksburg, VA

Denise D. Walker, and
University of Washington, Seattle, WA

Roger A. Roffman
University of Washington, Seattle, WA

Abstract

Background—Heavy cannabis use has been associated with negative outcomes, particularly among individuals who begin use in adolescence. Motives for cannabis use can predict frequency of use and negative use-related problems. The purpose of the current study was to assess change in motives following a motivational enhancement therapy (MET) and cognitive behavioral therapy (CBT) intervention for adolescent users and assess whether change in motives was associated with change in use and self-reported problems negative consequences.

Methods—Participants (n=252) were non-treatment seeking high school student cannabis users. All participants received two sessions of MET and had check-ins scheduled at 4, 7, and 10 months. Participants were randomized to either a motivational check-in condition or an assessment-only check-in. Participants in both conditions had the option of attending additional CBT sessions. Cannabis use frequency, negative consequences, and motives were assessed at baseline and at 6, 9, 12, and 15 month follow-ups.

Corresponding author: Claire E. Blevins, Claire_Blevins@Brown.edu, Butler Hospital, 345 Blackstone Blvd., Providence, RI 02906, USA.

Contributors

DW, RR, and RS conceived, designed, and implemented the parent trial. CB and KB conceived the aims of this paper. CB and KB wrote the initial draft of the manuscript and performed statistical analyses. All authors discussed the results and contributed to and have approved the final manuscript.

Conflict of interest

No conflict declared.

Results—There were significant reductions in motives for use following the intervention and reductions in a subset of motives significantly and uniquely predicted change in problematic outcomes beyond current cannabis use frequency. Change in motives was significantly higher among those who utilized the optional CBT sessions.

Conclusions—This study demonstrates that motives can change over the course of treatment and that this change in motives is associated with reductions in use and problematic outcomes. Targeting specific motives in future interventions may improve treatment outcomes.

Keywords

motivation; treatment outcomes; cannabis

1. INTRODUCTION

Drinking and drug use motives are important predictors of alcohol and drug use and related negative consequences (Banes et al., 2014; Buckner, 2013; Kuntsche et al., 2005). Identification of motives for use provides potential targets for secondary prevention efforts and treatment interventions. For example, using in order to cope with negative affect assessed prior to an intervention for cannabis using adolescents positively predicted prevalence of use, dependence symptoms, and problems following the intervention (Fox et al., 2011). However few studies to date have examined whether users' motives for use change following intervention and whether changes in motives are related to changes in use and related problems.

Research with adult cannabis users found changes in motives for use following participation in a combination motivational enhancement therapy (MET) and cognitive behavioral therapy (CBT) treatment (Banes et al., 2014). Additionally, the change in motives – particularly the coping motive – was associated with reductions in cannabis use frequency, problems, and dependence symptoms at later follow-ups. A recent motivational and coping skills-based intervention also reported reductions in motives for drinking post-intervention (Blevins and Stephens, 2016).

The majority of previous research on cannabis use motives has utilized the Marijuana Motives Measure (MMM; Simons et al., 1998), a five-factor scale derived from research on drinking motives (Drinking Motives Questionnaire-Revised (DMQ-R); (Cooper, 1994). The DMQ-R included four motives based on valence (positive, negative) and source (internal, external): enhancement (positive, internal), social (positive, external), coping (negative, internal), and conformity (negative, external). The MMM added the motive of expansion of the mind to account for distinct effects associated with cannabis. However, a more recent cannabis motive measure, the Comprehensive Marijuana Motives Questionnaire (CMMQ; Lee et al., 2009) utilized a bottom-up approach to identify additional motives for use in a college population. The CMMQ has 12 subscales that include motives assessed by the MMM as well as previously unstudied reasons for using. Notably, the negative valence, internal source motive of social anxiety absent from the MMM was added. Negative affect motives for use have been found to be markers of problematic use and outcomes (e.g., Fox et al., 2011; Grant et al., 2007), suggesting that adding additional negative affect motives may

be useful. Indeed, the CMMQ motive scales explained additional variance in use and consequences above and beyond the MMM in an initial study with college students (Lee et al., 2009). Confirmatory factor analysis of the CMMQ showed that the factor and subscale structure were replicated in much younger and more problematic population of cannabis users (Blevins et al., 2016). The present paper extends work on the clinical utility of the CMMQ by using the same sample of adolescent cannabis users to study change in motives following an intervention for cannabis use. If changes in particular motives following intervention are related to changes in negative consequences of cannabis use it will strengthen the argument for targeting those motives in future treatment programs.

The purpose of the present paper is to examine change in motives assessed with CMMQ among adolescents participating in a MET/CBT-based intervention. The current evaluation has two goals: (1) to assess whether motives changed following intervention; and (2) to identify changes in motives that were associated with cannabis use outcomes. Given the relative lack of research that utilizes the CMMQ, this study aimed to evaluate specifically whether the previous relationships between motives and outcomes were replicated and whether additional motives scales were useful predictors. It was hypothesized that most motives would be reduced through participation in the intervention. Further, it was predicted that reductions in negative affect motives such as using to cope or using for social anxiety would be particularly associated with a reduction in use and problematic outcomes.

2. METHODS AND MATERIALS

2.1 Parent Clinical Trial Design

In order to examine whether motives for marijuana use changed following an intervention, data from a randomized controlled treatment trial for cannabis-using adolescents were examined (Walker et al., in press). The goal of the parent clinical trial was to determine whether periodic MET-based check-ins following an initial two-session MET intervention would lead to greater long-term reductions in use and problematic outcomes. Participants were 252 adolescent marijuana users randomized to either a motivational check-in condition (MCI; n = 128) or an assessment-only check-in condition (ACI; n = 124). All participants initially received two sessions of MET designed to encourage reduction in cannabis use (see Berghuis et al., 2006; Walker et al., 2011). The check-ins (either MET-based or assessment-only) were scheduled at 4, 7, and 10 months. Cannabis use and negative consequences outcomes were assessed at 6, 9, 12, and 15 months. Participants in both conditions had the option to participate in individual CBT sessions throughout the first twelve months of the follow-up period if they desired additional help in reducing cannabis use. The primary hypothesis of the parent trial was that the MET-based check-in sessions dispersed throughout the follow-up period would encourage greater reductions in cannabis use and negative consequences than the assessment-only check-ins and that some of this effect would be mediated by greater attendance of the optional CBT sessions by those in the MCI condition. The Institutional Review Boards at the University of Washington and Virginia Tech approved all procedures.

2.2 Participants

The study recruited high school freshman, sophomore, and juniors from 6 Seattle, Washington high schools. A total of 445 students initially expressed interest in participating in the study. A total of 252 students were eligible and consented to participation in the study. The IRB agreed that parental consent was not required for participation. Individuals were excluded from participation if, at screening, they used cannabis fewer than 9 days over the past 30 (n=154, 84.6%) in an attempt to recruit participants who were using on weekdays (c.f. Walker et al., 2011), were planning on moving outside of the Seattle region through the course of the study (n=27, 14.8%), if they were seniors and planning on graduating before the end of the study (n=19, 10.4%), or if they had a serious medical or psychiatric condition (n=3, 1.6%). Eleven individuals who were eligible for participation declined enrollment, which left a final sample of 252 for the intervention. At the baseline assessment, the sample reported cannabis use on an average of 37.07 days of the last 60 (SD=15.05, range = 1 day to 60 days), and was comprised of mostly males (68%) with a mean age of 15.84 at baseline (SD=.96; range = 14–17 at baseline, 15–19 at the final follow-up assessment). Three-quarters of the sample met diagnostic criteria for a DSM-IV cannabis use disorder (75.0%) (American Psychiatric Association, 2000). The sample was fairly diverse: 59% Caucasian, 20% multiracial, 6% African American, 4% Asian, and 11% other. Additional details on recruitment and demographics can be found in the main outcomes paper (Walker et al., in press).

2.3 Measures

All measures used in this paper were administered and answered privately via computer at baseline and through online assessments accessed by participants at each follow-up assessment. Motives for cannabis use were measured at baseline and all follow-ups using the CMMQ (Lee et al., 2009), a 36-item measure that asks participants how frequently they use cannabis for various reasons. Each of the 12 subscales consists of 3 items that were averaged to create the scale scores used in the current analyses. The CMMQ utilizes a scale of 1 (“ almost never or never”) to 5 (“ almost always or always”). Internal consistency reliabilities (alphas) for the 12 scales across baseline and follow-up assessments ranged across time as follows: Enjoyment (.79 – .90), Conformity (.66 – .85), Coping (.85 – .91), Experimentation (.76 – .89), Boredom (.82 – .93), Alcohol Use (.77 –.91), Celebration (.88 – .93), Altered Perceptions (.86 – .94), Social Anxiety (.76 – .91), Relative Low Risk (.71 – . 88), Sleep.(85 – .91) and Availability (.69 – .89). For further information on the psychometric properties of the CMMQ in the present sample see Blevins and colleagues (2016).

Self-reported cannabis use frequency over the last 60 days was measured at baseline and each follow-up with a single question from the Global Appraisal of Individual Needs (GAIN; Dennis et al., 2008). Participants reported the total number of days of use over the past 60 days. This measure has demonstrated good reliability and predictive validity and has been found to have excellent comparability with other indices of use (Dennis et al., 2004).

Cannabis-related problems were assessed with the Marijuana Problems Index (Johnson and White, 1995), a 23-item measure derived from the Rutgers Alcohol Problems Index (White

and LaBouvie, 1989). Participants rate how frequently they have experienced 23 problems over the past 60 days on a scale of 0 (“ never”) to 4 (“ more than 10 times”). The score was derived by averaging the items (alphas = .86– .97).

Symptoms of Cannabis Use Disorder were measured utilizing items adapted from the GAIN that have been found to be reliable and a valid measure of use disorder criteria (Dennis et al., 2008). Participants indicated whether or not they had experienced each DSM-IV symptom of cannabis abuse or dependence over the previous 60 days. The number of symptoms endorsed (range = 0–11) were summed to create a total symptom score (alphas = .77– .92).

2.4 Procedures

2.4.1 Recruitment and General Procedures—Participants were recruited through classroom presentations, referral by high school staff, lunchtime information tables, word of mouth, and brochures over the course of two academic years: 2011–2012 and 2012 – 2013. A total of 4,084 students were reached through these efforts. The study was advertised as a chance to talk about personal cannabis use and received individualized feedback. After initial screening for eligibility, participants were randomized to either the MCI or ACI condition. The interventions were delivered by four bachelor's and master's-level clinicians referred to as Health Educators. Health Educators received training and ongoing supervision by a licensed clinical psychologist with experience in MET and CBT interventions. Check-in sessions were audiotaped and coded by two independent consultants using the Motivational Interviewing Treatment Integrity (MITI) coding indices (Moyers and Martin, 2010) to ensure treatment fidelity and the intended differences between conditions during the check-in sessions. For more information on health educator training and adherence see Walker and colleagues (in press).

Participants in both conditions completed a baseline assessment, which included assessment of cannabis use, motives, and related outcomes. They then met with health educators for two initial MET-based feedback sessions within a month following baseline assessment. Subsequently, they met with health educators at 4, 7, and 10 months post-baseline for check-in sessions (see sections 2.4.2 and 2.4.3). Outcomes were assessed for all participants with internet-based online follow-up assessments at 6, 9, 12 and 15-months post-baseline. Participants did not receive incentives for the baseline assessment or the two initial MET sessions. They earned $15 gift cards for participating in each check-in, $25 for each follow-up assessment, and an additional $40 bonus if they completed all check-in sessions and follow-up assessments.

2.4.2 MCI Condition—Participants in the MCI condition participated in additional MET-based check-in sessions with the same health educator at 4, 7, and 10 months post-baseline. Check-in sessions consisted of a brief computerized assessment (10–15 minutes) of recent cannabis use frequency and related consequences. The report generated from the assessment compared current data with the participant’s baseline data and the health educator use motivational interviewing techniques to support change that had occurred and to elicit motivation for additional change as needed. Health educators were trained in motivational

interviewing and coding of sessions demonstrated good treatment adherence and fidelity (see Walker et al., in press for additional details on the interventions).

2.4.3 ACI Condition—Participants in the ACI condition completed the same brief computerized assessment (10–15 minutes) at the same check-in time points to control for any effect of assessment, but did not receive a feedback report and did not engage with the health educator in discussing their cannabis use.

2.4.4 Optional CBT Sessions—Participants in both conditions could meet with their health educators for optional, free CBT sessions at any point following the initial two MET sessions and up until the 12-month follow-up. Further, at each check-in session participants in both conditions were reminded about the availability of the CBT sessions. CBT sessions were specifically recommended to participants in the MCI condition who continued to use cannabis 15 or more days per month, self-reported any cannabis abuse or dependence symptoms, or stated that their marijuana use negatively impacted one or more life goals at the check-in sessions.

2.5 Analysis Plans

Preliminary analyses utilized chi-square analyses to examine rates of attrition by condition. Repeated measures generalized linear modeling analyses (GLM) were utilized to examine changes in cannabis use frequency, related negative consequences, and motives for use. The repeated measures time effect in these analyses was defined by including all assessment points (i.e., baseline, 6-months, 9-months, 12-months, and 15 months). Initially, treatment condition was included in the models to detect differential change by treatment condition for each outcome variable and the motive scores. However, the lack of differences motive scores by condition at any assessment led to a decision to collapse data across conditions for the analyses presented in this paper. This decision was further supported by the absence of any a priori reasons to expect differential effects of conditions on motives. Change scores were computed for each subscale of the CMMQ at each follow-up by subtracting the baseline score from the follow-up score. Larger change scores therefore indicated less reduction (or an increase) between baseline and the follow-up assessments. Motive change scores were correlated with cannabis use outcomes (use frequency, problems, symptoms) at each follow-up assessment, controlling for the corresponding baseline measure for that outcome in order to determine whether changes in motives were related to changes in cannabis use frequency and negative consequences. Positive correlations indicated that reductions in motives were associated with reductions in cannabis use or consequences of use, whereas negative correlation indicated that as motives reduced cannabis use and consequences increased. Finally, motive change scores were simultaneously entered into multiple regression models to predict cannabis use outcomes at each follow-up. The regression analyses controlled for the baseline level of the outcome variable in order to predict residualized change. The motive change scores corresponding to the follow-up being predicted were used as the primary predictors in each model. Additionally, when examining prediction of cannabis related problems and use disorder symptoms, concurrent frequency of cannabis use at the follow-up assessment was an additional control variable in order to assess whether changes in motives provided additional explanatory power beyond currently reported number of days

of use. Given the number of motive scales simultaneously used as predictors in these regression analyses, Bonferroni corrections were used to reduce the risk of Type I errors. Significance values are reported at $p<.004$ (i.e. .05/12) and $p<.0008$ (i.e., .01/12).

3. RESULTS

3.1 Primary Analyses

3.1.1 Parent Trial Overall Outcomes—Follow-up rates were as follows: 96% (6-month), 94% (9-month), 92% (12-month), and 91% (15-month). No significant attrition by condition was found (*ps* = .75, .17, .36, and .08). Sixty-five participants (26%) attended the optional CBT sessions. Analyses of attendance by condition revealed no significant differences: ACI ($n = 33$; $M = 4.3$ sessions), MCI ($n = 32$; $M = 4.4$ sessions). Prevalence of use, problems, and cannabis use symptoms were significantly reduced in both conditions at all follow-ups relative to baseline. Participants in the MCI condition reported significantly greater reductions in frequency of cannabis use and negative consequences at the 6-month follow-up compared to the ACI condition, but results from later follow-ups revealed no significant differences by condition (see Walker et al., in press, for a full description of treatment outcomes).

3.1.2 Cannabis Outcomes and Motive Change over Time—Descriptive statistics for motives subscales, days of cannabis use, use-related problems, and symptoms are displayed in Table 1. Motive subscales exhibited skew; however, after computation of change scores, skew was decrease. There were no significant time by condition effects indicating differential change in motives by treatment condition at any follow-up. (all *ps* >. 05). Thus, data were collapsed across conditions for analyses using motive changes scores to predict cannabis use outcomes at the follow-up assessments. Enjoyment was the most commonly-endorsed motive for use at baseline while Conformity, Alcohol Use, and Experimentation were the least commonly endorsed. Significant time effects were found for all motive scales in the GLM analyses, with the exception of Conformity. Inspection of means indicated that endorsement of motives was reduced at each follow-up relative to baseline (see Table 1).

3.1.3 Motives Change and Outcomes—Partial correlations in which motives change scores were correlated with cannabis use outcomes (cannabis use frequency, cannabis-related problems, and cannabis symptoms), controlling for the respective variables as measured at baseline, are displayed in Table 2. Results indicated all motives change scales were associated with change in frequency of use, problems, and symptoms at all follow-ups.

To test whether specific motives explained variance in cannabis use outcomes over and above other motives, regression models in which all motives change scores were entered simultaneously into the model are displayed in Table 3. As with the partial correlations in Table 2, the baseline value of the cannabis variable being predicted was entered to allow the change in motive scores to predict residualized change in the cannabis outcomes. Concurrently assessed cannabis use frequency was also entered when predicting negative consequences (cannabis-related problems and cannabis use disorder symptoms). Given the number of comparisons, results were interpreted with Bonferroni corrections. In these

analyses the coping motive scale showed the most consistent prediction of cannabis use outcomes. Reductions in the Coping motive were significantly associated with fewer cannabis-related problems at 6-months, 9-months, and 12-months even though there were no relationships between using to cope and frequency of use.

Reductions in the alcohol motive were related to reduction in marijuana-related problems only at 6-months. Reductions in Altered Perception motives were associated with reductions in cannabis use frequency at the 9- and 12-month time points, but not with negative consequences at any follow-up. Reductions in the Boredom motive showed inconsistent relationships with outcome variables. They were related to reductions in cannabis use frequency at 12 months and to reductions in cannabis use disorder symptoms at the 15-month time point. Reductions in the Experimentation motive at 15 months were related to decreased cannabis problems, but showed no significant relations with other outcomes at any follow-up. Finally, reductions in Conformity motives showed opposite relationships with outcome indices at the 12-month follow-up. They were associated with fewer cannabis-related problems and greater numbers of disorder symptoms.

3.2 Exploratory Post-Hoc Analyses

We explored whether participation in the optional CBT sessions available to both conditions was associated with greater motive change. Analyses revealed that there was no difference in the number of CBT sessions attended between treatment conditions, but correlational analyses indicated that those participants who used more CBT sessions had greater reductions in cannabis use frequency and related problems (Walker et al., 2016). Thus, we focused on relationships between CBT attendance and motive change at the 12 and 15-month follow-ups because they occurred after access to additional CBT sessions ended. Exploratory analyses showed that the number of CBT sessions attended as of the 12-month follow-up predicted 12- and 15-month change in Social Anxiety (12-month beta = −.15, p=.03; 15-month beta = .− 17, p=.01), Availability (12-month beta = −.16, p=.02; 15-month beta = −.18, p=.01), Boredom (12-month beta = .−.18, p<.01; 15-month beta = −.19, p<.01), Celebration (12-month beta = .− 17, p=.01; 15-month beta = −.18, p=.01), Coping (12-month beta = −.22, p<.01; 15-month beta = −.21, p<.01), Enjoyment (12-month beta = −.14, p=.03; 15-month beta = −.14, p=.04), and Experimentation (12-month beta = .13, p=.04; 15-month beta = −.13, p=.05) motives.

4. DISCUSSION

Results from this study demonstrated that motives for cannabis use decreased following a brief intervention designed to reduce cannabis use frequency in a sample of frequent adolescent users. The changes in motives were sustained throughout a 15-month follow-up period. In univariate analyses, reductions in all motives assessed by the CMMQ were significantly related to reductions in frequency of use and negative consequences of use following an intervention. More importantly, several motive change scores significantly predicted change in treatment outcome variables in multivariate analyses that controlled for other motives. Notably, change in the coping motive fairly consistently predicted reductions in cannabis-related problems over and above other motives change scales and concurrent

cannabis use. Although differences in the types of check-in interventions did not produce differential change in motives, the total number of optional CBT sessions attended predicted change in several motives for use and partially supported the conclusion that treatment can systematically affect reasons for use which in turn are related to negative consequences of use. The findings suggest that interventions should systematically target motives for cannabis use to decrease negative consequences.

Reductions in using to cope were a relatively consistent predictor of reductions in post-intervention cannabis problems above and beyond other motives for use and concurrently measured frequency of cannabis use. Using to cope has been related to problematic use indices in a variety of studies (Bonn-Miller et al., 2007; Fox et al., 2011; Lee et al., 2009), but fewer studies have addressed whether systematic reductions in the coping motives are associated with reductions in negative consequences (cf. Banes et al., 2014; LaBrie et al., 2008). Thus, the present findings offer somewhat stronger support for a causal relationship between using to cope and negative consequences. The correlational nature of the findings cannot rule out third-variable explanations for the relationship between using to cope and negative consequences, but the fact that the two variables change together is a at least more suggestive of a causal relationship than previous cross-sectional findings or predictions of future negative consequences based on static pretreatment measures of motives. Interestingly, the mean endorsement of the coping motive was relatively low compared to other motives for use, yet retained unique predictive power. The level of endorsement of using cope was similar to other heavy cannabis-using samples (e.g., Fox et al., 2011). Thus, even relatively infrequent rates of using to cope are still a robust predictor of negative outcomes and provide further evidence that treatments that incorporate enhancement of adaptive coping strategies in the face on internal distress can be an effective strategy to reduce problematic use.

Prediction of problematic outcomes by change in other motives measured by the CMMQ in the multivariate analyses was less consistent and in some cases counter intuitive. Reducing use to alter perceptions was related to reduced frequency of cannabis use at two of four follow-ups, but did not predict changes in negative consequence outcomes. The Altered Perceptions scale of the CMMQ is most similar to the Expansion scale of the MMM. Previous findings have noted relationships between Expansion scores and rates of cannabis use (Bonn-Miller et al., 2007; Simons et al., 1998), but not use-related consequences (Fox et al., 2011). Thus, using to experience altered perceptions may lead to more use, but not necessarily problematic use.

The Boredom subscale is unique to the CMMQ and changes in it covaried with frequency of use at 12 months and CUD symptoms at 15 months. The Boredom scale was previously been linked to frequency of use but not problems associated with use (Lee et al., 2009). The inconsistent associations in the present study caution against over interpretation until replicated. However, few studies have examined the boredom motive, which may be more salient in adolescence when individuals have fewer responsibilities and less daily structure. It may be a more important intervention target for this age group if its relationship with negative outcomes is substantiated.

Results for the Conformity scale of the CMMQ were somewhat unexpected and internally contradictory. Change in the conformity motive was positively associated with problems, but negatively associated with CUD symptoms at the 12 month follow-up. The Conformity motive has been assessed through the MMM and the DMQ-R, and is theoretically associated with lighter, less problematic use (Cooper, 1994). Research on outcomes associated with the Conformity motive has been largely inconsistent. Among adolescents, use of alcohol for conformity motives was related to fewer problems (Willem et al., 2012) in some samples, but positively predicted problems in other adolescents who used alcohol (Cooper, 1994; Kuntsche et al., 2008) and cannabis (Fox et al., 2011). Among undergraduates, the relationship between conformity and problems has also been inconsistent (Buckner et al., 2012b; Merrill and Read, 2010; Simons et al., 1998). It is hypothesized that conformity is less relevant as age increases and is gradually replaced by other motives for use (Cooper, 1994), so we might have expected greater endorsement in our adolescent sample. However, our sample was selected for frequent cannabis use and conformity motives may be more prevalent in inexperienced occasional users. The infrequent endorsement in our sample also raises the possibility that the inconsistent findings may be due to floor effects. It was the only motive to not exhibit a significant change over time. Findings in the present study may be a statistical anomaly that requires further evaluation. Inconsistent findings may also be attributed to the lower alpha coefficient for the Conformity scale, which may suggest that the scale items do not uniformly represent the motive

Interestingly, the Social Anxiety scale of the CMMQ did not emerge as an important predictor of outcomes once other motives were considered. Assessment of this motive is unique to the CMMQ and previously was found to be associated with cannabis use frequency and negative consequences (Lee et al., 2009). Additionally, a number of studies have found a link between social anxiety and negative consequences associated with use, such as cannabis-related problems and cannabis dependence symptomatology (e.g., Buckner et al., 2007, 2012b). Buckner and colleagues (Buckner et al., 2012a) developed a Marijuana Use to Cope with Social Anxiety Scale (MCSAS), and found relationships between using cannabis to cope with social anxiety and avoidance of social situations when cannabis was unavailable. Among those with clinically-elevated levels of social anxiety there was evidence that using to cope with social anxiety mediated the relationship between social anxiety symptomatology and cannabis use-related problems. Thus, the lack of findings between social anxiety, use, and negative use-related outcomes in our sample may indicate that there were too few individuals with significant social anxiety symptomatology or may be a result of utilizing the CMMQ instead of the MCSAS. Additionally, our sample recruited heavy-using adolescents, many of whom met diagnostic criteria for a cannabis use disorder while the other studies relied on an older, normative populations which suggests that either age or use pattern may impact these relationships.

The present study was not designed to target motives for use systematically and participants in both conditions received similar MET and CBT interventions. Although the MCI condition check-ins included additional feedback on progress toward reduction goals and additional motivational interviewing to encourage reductions in use, these sessions did not offer any additional examination of reasons for use or encouragement to reduce use for particular reasons. Thus, differential change in motives was not expected and the reductions

in motives throughout the follow-up period cannot be unequivocally attributed to the interventions. However, the utilization of the optional CBT sessions predicted a reduction in some motives at the 15-month follow-up including using to cope and using for boredom. The relationship between CBT participation and change in motives is logically consistent in that CBT helps individuals identify antecedents to use and learn new ways of dealing with those situations. These findings suggest that the discussion of alternative coping strategies during CBT treatment may be helpful for participants who rely on substances to cope with negative affective states. Future studies should evaluate these possibilities by utilizing a designs that could specifically test the impact of CBT sessions on change in motives and subsequent treatment outcomes.

The differences seen in relationships between motives and problems versus motives and use disorder symptoms was not hypothesized. Previous studies often find that motives, when assessed via the MMM, are related to both indices of negative consequences (e.g., Banes et al., 2014; Fox et al., 2011). Many CUD symptoms are more abstract and subjective than the relatively concrete events and consequences assessed by problem scales, perhaps leading to less reliability in self-reports that diminishes relationships. Future research on the consequences of motives would benefit from true diagnostic interviews to assess CUD symptoms.

The relative lack of associations between motives and frequency of use is consistent with previous literature on change in motives, which found a more robust relationship with other indicators of problematic use (Banes et al., 2014). This lack of relationship with frequency of use is most evident in multivariate analyses where the effects of multiple motives are considered simultaneously. Current motive assessment inherently taps into frequency of use by asking participants to report how often they use for each reason. More frequent users are more likely to use for multiple reasons and score higher on almost every motive. The univariate results in the present study demonstrate how reduction in frequency of use at follow-up was related to reduction in every motive assessed. Thus, controlling for the multiple reasons in multivariate analyses may spread the explained variance in use across all motives resulting in no unique contributions of any specific motives. These findings highlight the weakness of frequency of cannabis use as a measure of problematic use in a heavy-using population. Reported days of use may not capture the patterns of cannabis use that lead to the problematic outcomes. For example, some individuals may use a small quantity of cannabis once a day before bed while others may be using cannabis throughout the day. More research is needed to tease apart the use patterns or use situations associated with specific motives (e.g., using to cope) that result in their relationships with negative consequences.

Several limitations for this study should be noted. This study relied on self-report of cannabis use and problematic outcomes. Although self-report of use has been found to be a reliable method of assessment (Del Boca and Darkes, 2003), it may be useful to include observer reports in the future to assess other problematic outcomes. Additionally, the purpose of this study was not specifically to change motives for use, and motives were not specifically targeted throughout the course of treatment. Future research should examine motives-specific treatment interventions. For example, there is preliminary evidence in an

alcohol-using population that a coping motive-specific brief feedback intervention could reduce motives and problematic outcomes (see Blevins and Stephens, 2016). Additionally, an intervention that incorporated motives education was associated with reductions in motives for use and subsequent negative outcomes (LaBrie et al., 2008). Although the size of the relationships between motives and outcomes in this study are relatively small, they emerged after controlling for frequency of cannabis use and other motives. Thus, the impact of specific motives was evident above and beyond at least one index of cannabis use and suggested that greater focus on known problem-related motives in treatment interventions could augment the effects.

Overall, this study adds to a growing literature on the unique relationships between motives for drug use and negative consequences of use. Almost all motives for use reduced over the course of treatment, but change is specific motives was more related to reduction in some negative consequences of use. In particular, using to cope with negative affect and, perhaps, with boredom deserve greater attention in the design of future interventions for adolescent cannabis users.

Acknowledgments

Role of funding source

Funding for this study was provided by NIDA Grant 1RO1DA014296-01A1;NIDA had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the

REFERENCES

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders DSM-IV-TR Fourth Edition (Text Revision). Washington, DC: American Psychiatric Publications; 2000.

Banes KE, Stephens RS, Blevins CE, Walker DD, Roffman RA. Changing motives for use: outcomes from a cognitive-behavioral intervention for marijuana-dependent adults. Drug Alcohol Depend. 2014; 139:41–46. [PubMed: 24685559]

Blevins CE, Banes KE, Stephens RS, Walker DD, Roffman RA. Motives for marijuana use among heavy-using high school students: an analysis of structure and utility of the Comprehensive Marijuana Motives Questionnaire. Addict. Behav. 2016; 57:42–47. [PubMed: 26878304]

Blevins CE, Stephens RS. The impact of motives-related feedback on drinking to cope among college students. Addict. Behav. 2016; 58:68–73. [PubMed: 26914263]

Bonn-Miller MO, Zvolensky MJ, Bernstein A. Marijuana use motives: concurrent relations to frequency of past 30-day use and anxiety sensitivity among young adult marijuana smokers. Addict. Behav. 2007; 32:49–62. [PubMed: 16647822]

Buckner JD. College cannabis use: the unique roles of social norms, motives, and expectancies. J. Stud. Alcohol Drugs. 2013; 74:720–726. [PubMed: 23948531]

Buckner JD, Bonn-Miller MO, Zvolensky MJ, Schmidt NB. Marijuana use motives and social anxiety among marijuana-using young adults. Addict. Behav. 2007; 32:2238–2252. [PubMed: 17478056]

Buckner JD, Heimberg RG, Matthews RA, Silgado J. Marijuana-related problems and social anxiety: the role of marijuana behaviors in social situations. Psychol. Addict. Behav. 2012a; 26:151–156. [PubMed: 22004129]

Buckner JD, Heimberg RG, Schneier FR, Liu S-M, Wang S, Blanco C. The relationship between cannabis use disorders and social anxiety disorder in the National Epidemiological Study of Alcohol and Related Conditions (NESARC). Drug Alcohol Depend. 2012b; 124:128–134. [PubMed: 22266089]

Buckner JD, Zvolensky MJ, Schmidt NB. Cannabis-related impairment and social anxiety: the roles of gender and cannabis use motives. Addict. Behav. 2012c; 37:1294–1297. [PubMed: 22766487]

Cooper ML. Motivations for alcohol use among adolescents: development and validation of a four-factor model. Psychol. Assess. 1994; 6:117–128.

Del Boca FK, Darkes J. The validity of self-reports of alcohol consumption: state of the science and challenges for research. Addiction. 2003; 98:1–12. [PubMed: 14984237]

Dennis ML, Funk R, Godley SH, Godley MD, Waldron H. 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 Suppl. 2004; 2:120–128.

Dennis, ML.; White, M.; Titus, JC.; Unsicker, MS. Global Appraisal of Individual Needs: Administration Guide for the GAIN and Related Measures (Version 5). Bloomington, IL: 2008.

Fox CL, Towe SL, Stephens RS, Walker DD, Roffman RA. Motives for cannabis use in high-risk adolescent users. Psychol. Addict. Behav. 2011; 25:492–500. [PubMed: 21688873]

Grant VV, Stewart SH, O'Connor RM, Blackwell E, Conrod PJ. Psychometric evaluation of the five-factor Modified Drinking Motives Questionnaire--Revised in undergraduates. Addict. Behav. 2007; 32:2611–2632. [PubMed: 17716823]

Johnson V, White HR. The relationship between work-specific and generalized stress and alcohol and marijuana use among recent entrants to the labor force. J. Drug Issues. 1995; 25:237–251.

Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. Clin. Psychol. Rev. 2005; 25:841–861. [PubMed: 16095785]

Kuntsche E, Stewart SH, Cooper ML. How stable is the motive-alcohol use link? A cross-national validation of the Drinking Motives Questionnaire Revised among adolescents from Switzerland, Canada, and the United States. J. Stud. Alcohol Drugs. 2008; 69:388–396. [PubMed: 18432381]

LaBrie JW, Huchting K, Tawalbeh S, Pedersen ER, Thompson AD, Shelesky K, Larimer M, Neighbors C. A randomized motivational enhancement prevention group reduces drinking and alcohol consequences in first-year college women. Psychol. Addict. Behav. 2008; 22:149–155. [PubMed: 18298242]

Lee CM, Neighbors C, Hendershot CS, Grossbard JR. Development and preliminary validation of a comprehensive marijuana motives questionnaire. J. Stud. Alcohol Drugs. 2009; 70:279–287. [PubMed: 19261240]

Merrill JE, Read JP. Motivational pathways to unique types of alcohol consequences. Psychol. Addict. Behav. 2010; 24:705–711. [PubMed: 20822194]

Moyers T, Martin T. Revised Global Scales: Motivational Interviewing Treatment Integrity 3.1.1 (MITI 3.1.1). Univ. New Mex. 2010; 1:1–29.

Simons J, Correia CJ, Carey KB, Borsari BE. Validating a five-factor marijuana motives measure: relations with use, problems, and alcohol motives. J. Couns. Psychol. 1998; 45:265–273.

Walker DD, Stephens R, Roffman R, DeMarce J, Lozano B, Towe S, Berg B. 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. 2011; 25:474–484. [PubMed: 21688877]

Walker DD, Stephens RS, Blevins CE, Banes KE, Matthews L, Roffman RA. Augmenting brief interventions for adolescent marijuana users: the impact of motivational check-ins. n.d.

White HR, LaBouvie EW. Towards the assessment of alcohol problem drinking. J. Stud. Alcohol. 1989; 50:30–37. [PubMed: 2927120]

Willem L, Bijttebier P, Claes L, Uytterhaegen A. Temperament and problematic alcohol use in adolescence: an examination of drinking motives as mediators. J. Psychopathol. Behav. Assess. 2012; 34:282–292.

Highlights

- Motives for cannabis use can predict problematic use and use-related problems
- A MET/CBT intervention was associated with significant reductions in motives
- Reductions in a subset of motives significantly predicted change in outcomes

Table 1

Descriptive Statistics

	Baseline	6 Months	9 Months	12 Months	15 Months	Sig
Use and Related Outcomes						
Cannabis Use (Days)	37.07 (15.06)	29.62 (20.27)	30.09 (21.38)	29.01 (22.07)	30.45 (22.19)	**
Cannabis Problems	1.61 (.45)	1.41 (.62)	1.28 (.60)	1.26 (.71)	1.31 (.81)	**
Cannabis Symptoms	3.65 (2.60)	2.65 (2.76)	2.04 (2.50)	1.97 (2.65)	2.15 (2.92)	**
Motives						
Alcohol	1.43 (0.64)	1.37 (0.78)	1.29 (0.67)	1.22 (0.80)	1.28 (0.83)	**
Altered Perception	2.48 (1.17)	2.29 (1.25)	2.19 (1.31)	2.01 (1.34)	2.09 (1.40)	**
Social Anxiety	2.11 (1.02)	1.70 (0.99)	1.52 (0.98)	1.34 (0.91)	1.48 (1.07)	**
Availability	2.82 (1.05)	2.64 (1.23)	2.44 (1.33)	2.32 (1.36)	2.37 (1.41)	**
Boredom	2.45 (1.04)	2.32 (1.26)	2.15 (1.22)	2.06 (1.34)	2.10 (1.31)	**
Celebration	2.51 (1.05)	2.15 (1.08)	2.04 (1.19)	1.90 (1.22)	1.89 (1.19)	**
Conformity	1.16 (0.39)	1.17 (0.58)	1.10 (0.57)	1.07 (0.65)	1.17 (0.76)	
Coping	1.95 (1.07)	1.62 (1.04)	1.54 (1.11)	1.42 (1.00)	1.49 (1.09)	**
Enjoyment	4.00 (0.98)	3.53 (1.35)	3.31 (1.47)	3.13 (1.60)	3.07 (1.58)	**
Experimentation	1.44 (0.70)	1.34 (0.79)	1.26 (0.81)	1.18 (0.79)	1.33 (0.95)	**
Sleep	2.56 (1.22)	2.18 (1.28)	1.98 (1.23)	1.85 (1.21)	1.96 (1.29)	**
Relative Low Risk	2.54 (1.20)	2.20 (1.38)	2.05 (1.32)	1.87 (1.32)	1.95 (1.35)	**

Note: significant values represent repeated measures GLM analyses of time

** p-values are significant at the 0.01 level

* p-values are significant at the 0.05 level

Table 2

Partial Correlations among Motives Change Scores and Cannabis Outcomes

	6 Months			9 Months			12 Months			15 Months		
Motive Change	**Use**	**MPI**	**CUD**	**Use**	**MPI**	**CUD**	**Use**	**MPI**	**CUD**	**Use**	**MPI**	**CUD**
ΔAlcohol	−0.02	0.39**	0.15*	0.20**	0.37**	0.15*	0.20**	0.43**	0.23**	0.24**	0.45**	0.29**
ΔAltered Perception	0.30**	0.37**	0.23**	0.40**	0.46**	0.29**	0.50**	0.49**	0.32**	0.42**	0.53**	0.37**
ΔSocial Anxiety	0.27**	0.37**	0.28**	0.36**	0.45**	0.29**	0.36**	0.49**	0.34**	0.37**	0.53**	0.39**
ΔAvailability	0.20**	0.36**	0.21**	0.24**	0.46**	0.30**	0.38**	0.53**	0.33**	0.34**	0.54**	0.33**
ΔBoredom	0.27**	0.38**	0.33**	0.36**	0.42**	0.32**	0.49**	0.55**	0.40**	0.37**	0.55**	0.44**
ΔCelebration	0.19**	0.29**	0.19**	0.23**	0.33**	0.13*	0.38**	0.48**	0.23**	0.40**	0.45**	0.27**
ΔConformity	0.20**	0.48**	0.30**	0.29**	0.44**	0.24**	0.35**	0.57**	0.14*	0.35**	0.60**	0.38**
ΔCoping	0.26**	0.54**	0.36**	0.36**	0.54**	0.34**	0.40**	0.57**	0.32**	0.33**	0.58**	0.38**
ΔEnjoyment	0.29**	0.35**	0.24**	0.36**	0.49**	0.32**	0.44**	0.50**	0.31**	0.42**	0.44**	0.30**
ΔExperimentation	0.26**	0.45**	0.21**	0.39**	0.42**	0.30**	0.38**	0.47**	0.29**	0.33**	0.47**	0.34**
ΔSleep	0.27**	0.34**	0.33**	0.31**	0.47**	0.30**	0.37**	0.49**	0.30**	0.30**	0.57**	0.34**
ΔRelative Low Risk	0.25**	0.30**	0.19**	0.30**	0.34**	0.17*	0.41**	0.42**	0.34**	0.34**	0.44**	0.27**

Δ. Change in motives from corresponding follow-up being predicted minus baseline. Note: analyses control for baseline level of outcome variable. Positive scores indicate reduction in motives were associated with a reduction in outcomes.

MPI = cannabis problems, CUD = cannabis use disorder symptoms;

** $p<.01$;

* $p<.05$

Drug Alcohol Depend. Author manuscript; available in PMC 2017 October 01.

Table 3

Standardized Regression Coefficients Predicting Outcomes

	6 Months			9 Months			12 Months			15 Months		
	Use	**MPI**	**CUD**	**Use**	**MPI**	**CUD**	**Use**	**MPI**	**CUD**	**Use**	**MPI**	**CUD**
Criterion	0.39**	0.44**	0.50***	0.43**	0.34**	0.45**	0.39**	0.30*	0.44**	0.31**	0.33**	0.41**
Concurrent MJ		0.17**	0.19*		0.24**	0.23*		0.29**	0.35**		0.19**	0.16
ΔR^2	0.19	0.27	0.32	0.21	0.26	0.30	0.17	0.31	0.35	0.11	0.27	0.25
ΔAlcohol	−0.15	0.21**	0.46	−0.03	−0.03	−0.08	−0.10	−0.13	0.11	−0.05	0.04	0.05
ΔAltered Perception	0.11	0.02	−0.02	0.15*	0.05	0.01	0.23*	−0.05	−0.07	0.15	0.04	0.05
ΔSocial Anxiety	0.03	−0.04	0.01	0.02	0.02	0.00	0.01	0.09	0.13	0.05	0.06	0.10
ΔAvailability	−0.03	−0.03	−0.09	−0.11	0.17	0.13	−0.04	0.08	0.04	−0.02	0.16	−0.04
ΔBoredom	0.10	0.05	0.17	0.14	−0.03	0.08	0.24*	0.05	0.17	0.05	0.14	0.26*
ΔCelebration	−0.03	−0.04	−0.03	−0.07	−0.08	−0.17	0.08	0.02	−0.10	0.14	−0.05	−0.10
ΔConformity	0.06	0.14	0.04	0.10	0.09	0.03	0.08	0.20*	−0.21*	0.17	0.17	0.10
ΔCoping	0.06	0.24**	0.15	0.08	0.18*	0.10	0.04	0.17*	0.12	−0.03	0.16	0.06
ΔEnjoyment	0.07	0.10	0.05	0.10	0.15	0.11	0.03	0.02	−0.05	0.17	−0.12	−0.06
ΔExperimentation	0.09	0.13	0.13	0.02	0.13	0.14	−0.02	0.00	0.05	−0.09	0.18*	0.06
ΔSleep	0.07	0.03	−0.03	0.16	0.10	0.11	0.02	0.09	−0.01	0.06	0.08	0.08
ΔRelative Low Risk	0.06	0.00	−0.02	0.18	−0.07	−0.13	0.08	−0.00	0.10	0.01	−0.04	−0.07
ΔR^2	0.15	0.28	0.10	0.21	0.25	0.11	0.29	0.28	0.09	0.23	0.33	0.15
Total R^2	0.34	0.55	0.42	0.42	0.51	0.41	0.46	0.59	0.44	0.34	0.60	0.40

Δ. Change in motives from corresponding follow-up being predicted minus baseline;

MPI = cannabis problems, CUD = cannabis use disorder symptoms.

Note: analyses control for baseline level of outcome variable (criterion variable). Positive scores indicate reduction in motives were associated with a reduction in outcomes.

* $p<.004$,

** $p<.0008$ (accounts for Bonferroni correction)