

Motives for Cannabis Use in High-Risk Adolescent Users

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The present investigation examined the relationships between motives for cannabis use and negative consequences associated with cannabis use following a brief intervention. The sample consisted of 205 adolescent cannabis users (66.3% male), who were recruited in high schools and randomly assigned to a brief two-session motivational enhancement therapy (MET) or an educational feedback control (EFC). Results supported the hypothesis that using cannabis to cope with negative affect would predict the number of problems and dependence symptoms related to cannabis use, after controlling for age, gender, years and frequency of cannabis use, and internalizing and externalizing behavior problems. Significant interactions between internalizing behavior problems and the coping motive showed that using to cope was associated with a higher number of cannabis dependence symptoms among adolescents reporting lower levels internalizing behavior problems. Findings support the potential utility of conducting further research to explore the coping motive as an important indicator of problematic cannabis use.

Keywords: cannabis, marijuana, adolescents, cannabis use motives, internalizing behavior problems

The illicit drug used most often by adolescents is cannabis and high rates of cannabis use disorders have been reported during this developmental period. In a recent study of high school students, more students reported using cannabis in the past year (33.7%) than all other types of illicit drugs combined (19.8%), and 39.7% of past-year cannabis users met criteria for a cannabis use disorder based on self-report (Chen, Sheth, Elliott, & Yeager, 2004). The numbers of teens who use cannabis increase over the course of adolescence (SAMHSA, 2008) and adolescent cannabis use has been identified as a risk factor for a wide range of problems. These problems include, but are not limited to, decreased short term memory, decreased ability to handle problems, school truancy and drop-out, risk taking behavior, interpersonal impairment, and respiratory problems (Dennis, 1999; Lynskey, Coffey, Degenhardt, Carlin, & Patton, 2003; Solowij et al., 2002; Tashkin, 1999). Identifying characteristics that are associated with less successful treatment outcomes may help improve cannabis treatment interventions by indicating the specific skills or areas of functioning where extra support is needed. Motives for cannabis use may be one such set of characteristics.

The motivational perspective of substance use is based on the idea that there is a relationship between an individual's motiva-

tions to attain specific types of valued outcomes, and his or her engagement in substance use behaviors (Cooper, 1994). Essentially, cannabis users regard cannabis use as a potential method for obtaining one or more of their desired outcomes. For example, using cannabis to cope with negative affect is based on a desire to alleviate negative emotions. Motivations for substance use can vary between and within individuals and they may function as a final pathway through which more distal factors, such as cognitive-affective variables, impact behavior (Simons, Gaher, Correia, Hansen, & Christopher, 2005). The five motives for cannabis use that have been studied most frequently are coping, conformity, social, enhancement, and expansion (Brodbeck, Matter, Page, & Moggi, 2007; Chabrol, Duconge, Casas, Roura, & Carey, 2005; Simons, Correia, & Carey, 2000). Cannabis use motives have been associated with frequency of cannabis use in cross-sectional college student samples (Bonn-Miller, Zvolensky, & Bernstein, 2007; Zvolensky et al., 2007), but there has been little research regarding the importance of motives for cannabis use within either adolescent or clinical populations. Prospective research is needed to understand whether motives for cannabis use explain future negative use-related consequences beyond other known risk factors.

Comorbid mental health issues are a type of risk factor often present among adolescents who are using substances (Roberts, Roberts, & Xing, 2007) and/or seeking substance abuse treatment (Chan, Dennis, & Funk, 2008). Specifically, high rates of internalizing and externalizing behavior problems have been reported within adolescent drug abusing samples (Chan et al., 2008; Winters, Stinchfield, Latimer, & Stone, 2008). Externalizing behavior problems, such as delinquent and aggressive behaviors and attention-deficit hyperactivity disorder, have been associated with early cannabis use, cannabis use disorders, and poorer treatment outcomes (Dobkin, Chabot, Maliantovitch, & Craig, 1998; Hayatbakhsh et al., 2008; King, Iacono, & McGue, 2004; Winters et al., 2008). Similarly, significant associations between internalizing behavior problems and cannabis use have been reported (Babor,

This article was published Online First June 20, 2011.

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This article is a secondary analysis of data, which was collected as part of the Teen Marijuana Check-Up. NIDA funded the parent study under grant number RO1DA014296. The authors have no conflicts of interest.

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Webb, Burleson, & Kaminer, 2002; Boys et al., 2003; Fergusson, Horwood, & Swain-Campbell, 2002; Wittchen et al., 2007), although there are inconsistencies in the literature (King et al., 2004; Tarter, Kirisci, Ridenour, & Vanyukov, 2008).

Within young adult samples, use of cannabis to cope with negative affect has been associated with a variety of internalizing behavior problems, such as anxiety sensitivity, anxious arousal and anhedonic depressive symptoms, and posttraumatic stress symptom severity (Bonn-Miller, Vujanovic, Feldner, Bernstein, & Zvolensky, 2007; Mitchell, Zvolensky, Marshall, Bonn-Miller, & Vujanovic, 2007; Zvolensky et al., 2007). Additionally, the coping motive for cannabis use was shown to partially mediate the relationship between social anxiety and cannabis use problems (Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007), and to interact with frequency of use when predicting anxious arousal, agoraphobic cognitions, and worry (Bonn-Miller, Zvolensky, Bernstein, & Stickle, 2008). Relationships between coping motives and internalizing behavior problems raise the question of whether they are unique, rather than redundant, predictors of cannabis use problems.

Although the association between externalizing behaviors and substance use is well known (Chan et al., 2008; Winters et al., 2008), exploration of relationships between externalizing behavior problems and cannabis use motives have been infrequent and yielded few significant associations. The existing studies have failed to find relationships between the various motives for cannabis use and sensation seeking or impulsivity constructs (Comeau, Stewart, & Loba, 2001; Simons et al., 2005). However, relationships between externalizing behavior problems and motives for cannabis use have not been explored in younger adolescents with clinically significant levels of cannabis use.

The overall aim of the current analyses is to examine the ability of cannabis use motives to predict frequency of cannabis use, and use-related consequences (i.e., problems associated with use and cannabis dependence symptoms), in a sample of adolescents who self-referred to participate in a brief cannabis use intervention. Given the known relationships between internalizing and externalizing behaviors problems and cannabis use, and their potential overlap with certain types of cannabis use motives (e.g., using to cope), analyses included indices of both types of behavior problems to control for their effects. The absence of previous studies of cannabis use motives within clinical samples of adolescent cannabis users led us to start by exploring the relationships of all motive subscales to cannabis use and use-related consequences; although the existing cross-sectional literature suggested that the coping motive would show the strongest association with criterion. Theory suggesting that motives for drug use may mediate the effects of more distal determinants (Simons et al., 2005) led us to hypothesize that the relationships between motives and cannabis use would remain after controlling for other predictors.

Finally, based on previous research indicating that both the coping motive and internalizing behavior problems predicted more adverse cannabis use, we hypothesized that those who had higher levels of internalizing problems and reported using cannabis to cope would experience more negative cannabis related consequences than predicted by the independent effects of these known predictors. Given the limited literature relating the coping motive and externalizing behavior problems, we explored whether a similar interaction between these constructs predicted greater cannabis use-related consequences.

Method

Study Design

Data were collected in public high schools in Seattle, Washington, as part of a randomized controlled treatment trial for adolescent cannabis users (Walker et al., in press). Informational sessions and flyers were used to recruit teens who wanted feedback about their cannabis use. Of the 619 screened participants, 320 were eligible (51.7%) and 310 of those eligible for the study chose to participate (96.9%). Inclusion criteria were: (a) 14–19 years of age, (b) enrolled in 9th through 12th grade, and (c) reported using cannabis nine or more days in past 30. Individuals were excluded if they: (a) were not fluent in English, (b) had a thought disorder that precluded full participation, or (c) refused to accept randomization to condition. The majority (98%) of ineligible participants had not used cannabis at least nine days in the past month. Eligible participants were randomly assigned to one of three intervention conditions: (a) motivational enhancement therapy (MET; $n = 103$), (b) educational feedback control (EFC; $n = 102$), or (c) delayed feedback control (DFC; $n = 105$). MET and EFC participants completed a full baseline assessment, received an intervention, and were reassessed at three and 12 months. Following the initial screening for eligibility, DFC participants did not provide additional assessment information until the 3-month follow-up, in order to create a no-assessment control condition. As a result, DFC participants were excluded from the present analyses, which relied on baseline assessment data.

Participants

The current analyses focused on the 205 participants randomly assigned to the MET and EFC conditions. Their mean age was 16.0 years ($SD = 1.25$). Participants were mostly male ($n = 136$, 66.3%) and Caucasian ($n = 137$, 66.8%) with 11% identifying as African American, 13% multiracial, 3% Hispanic or Latino, 2% Asian and Pacific Islander, and 3% other. Approximately 52% ($n = 106$) of participants were in the 9th or 10th grades and 48% ($n = 99$) were in the 11th or 12th grades. Follow-up rates were high for both the 3-month ($n = 201$, 98.0%) and 12-month ($n = 186$, 90.7%) follow-ups.

Assessment and Measures

Primary data were collected using an Audio-Computer-Assisted Self-Interviewing (A-CASI) program at baseline and follow-ups. The validity of using computer-assisted technology to assess a variety of potentially sensitive behaviors in adolescents and adults has been supported in previous research (Davis, Hoffman, Morse, & Luehr, 1992; Erdman, Klein, & Greist, 1983; McElrath, 1994; Turner et al., 1998; Webb, Zimet, Fortenberry, & Blythe, 1999).

Cannabis, alcohol, and other drug use. Frequency of cannabis, alcohol, and other drug use was assessed at baseline, 3-months, and 12-months by asking, "During the past 60 days, how many days did you use any kind of (marijuana/hashish, alcohol, recreational drugs other than alcohol or marijuana)?" Highly similar assessment of cannabis use frequency in adolescent clinical samples has been shown to have good reliability and validity (Dennis, Funk, Godley, Godley, & Waldron, 2004).

Internalizing and externalizing behavior problems. Internalizing and externalizing behavior problems were assessed at baseline using the Internal Behavior Scale (IBS) and the External Behavior Scale (EBS), respectively, from the GAIN-Q (Titus & Dennis, 2005). Both scales have been shown to have good reliability and validity (Titus, Dennis, Lennox, & Scott, 2008). The IBS consists of 17 items, which assess anxiety, depression, and suicidality, using items such as “During the past 12 months, have you had significant problems with feeling very trapped, lonely, sad, blue, depressed, or hopeless about the future?” and “feeling very anxious, nervous, tense, fearful, scared, panicked, or like something bad was going to happen?” The EBS consists of 16 items that assess symptoms of attention-deficit, hyperactivity, conduct disorder, aggressive behavior, and illegal activities. It includes items such as “Had a hard time paying attention at school, work, or home,” “Been a bully or threatened other people,” and “Hit someone or got into a physical fight.” Questions were answered using a Yes/No format and assessed symptoms over the past 12 months. Scores on these scales were calculated as a percentage, where the total number of problems positively endorsed was divided by the total number of possible problems. Higher scores reflected the endorsement of a greater number of symptoms. Cronbach’s alphas were .84 and .77 for the IBS and EBS respectively.

Cannabis dependence symptoms. Symptoms of cannabis dependence, as described in the Diagnostic and Statistical Manual of Mental Disorders IV (*DSM-IV*; American Psychiatric Association, 2000), were assessed at baseline, 3-months, and 12-months by adapting questions from the Substance Dependence Scale (SDS) of the GAIN-I. Research has supported the reliability and validity of this measure (Dennis, White, Titus, & Unsicker, 2008). To aid participants in understanding the intent of the questions, several complex items were broken down into more than one item, and brief examples of the problems, withdrawal symptoms, or psychological issues being referred to were provided. The seven total cannabis dependence symptoms were assessed using 10 items and participants were scored as having a symptom if they positively endorsed any of the items assessing that criterion. Across time points, Cronbach’s alpha for the SDS ranged from .79 to .84.

Cannabis problems. Problems related to cannabis use were assessed at baseline, 3-months, and 12-months using the Marijuana Problem Inventory (MPI), a 23-item self-report questionnaire adapted from the Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989). The cannabis adaptation of the RAPI has been validated in other research (Johnson & White, 1995; Simons, Correia, Carey, & Borsari, 1998). Questionnaire items assessed the extent to which individuals experienced problem behaviors associated with cannabis use over the past 60 days. Examples of items include, “Not able to do your homework or study for a test,” “Missed out on other things because you spent too much money on marijuana,” and “Went to work or school high.” Items were rated on a 5-point scale (0 = *never*, 4 = *more than 10 times*), and total scores were calculated by adding the item scores. Higher scores reflected greater problems associated with cannabis use. Cronbach’s alpha for the MPI ranged from .88 to .92 across time points.

Cannabis use motives. Cannabis use motives were assessed at baseline using the Marijuana Motives Measure (Simons et al., 1998). The 25-item scale is composed of five subscales, including enhancement (“I use marijuana because it’s fun”), coping (“I use

marijuana because it helps me when I am depressed or anxious”), conformity (“I use marijuana because my friends pressure me to use marijuana”), social (“I use marijuana because it makes social gatherings more fun”), and expansion (“I use marijuana so I can expand my awareness”). The five factor structure has been validated in studies consisting of both young adult and adolescent participants (Chabrol et al., 2005; Zvolensky et al., 2007). Items were rated on a 5-point scale (1 = *never or almost never*, 5 = *always or almost always*) and the subscale total scores were calculated by computing the means of item responses for each subscale. Higher subscales scores reflected using cannabis more often for a specific motive. Cronbach’s alphas for the sample were good (expansion = .86, coping = .84, conformity = .64, social = .80, enhancement = .73).

Procedures

All study procedures were approved by the IRB and the host high schools. Students were recruited to participate via classroom presentations, lunchtime information tables, or referral by friends, school staff, or project advertisements. Interested students were screened for eligibility and all ineligible applicants were offered a single MET session and behavior change resources if they indicated any interest in reducing or quitting cannabis use. Eligible participants reviewed a consent form with a counselor that explained all requirements of participation. The need for parental consent was waived by the IRB based on the rationale that this requirement would likely dissuade many cannabis using youth from participating in an intervention where the potential benefits outweighed the potential risks, and because adolescents in the state of Washington may legally seek treatment for substance abuse without parental consent. Consenting participants assigned to the MET and EFC conditions were scheduled to complete a baseline assessment within the week following eligibility determination and an intervention session within the week following baseline assessment completion.

Intervention conditions. The MET and EFC conditions each consisted of two 45–50 minute sessions scheduled approximately one and two weeks after the baseline assessment (Walker et al., in press).

MET. The goals for the first session included eliciting the teen’s story of cannabis use and evoking motivation for change by discussing reasons for using and abstaining, concerns regarding his or her use, and how cannabis was envisioned fitting into her or his life, currently and over the long-term. Motivational Interviewing skills and techniques, such as using open questions and reflective listening, developing discrepancy, and probing for motivation and change talk, were utilized throughout the session. The second session focused on reviewing the participant’s personal feedback report (PFR) and counselors used motivational interviewing throughout the session. PFR’s were constructed from the teen’s baseline assessment data and they included the following sections: (a) history of cannabis use; (b) patterns of recent cannabis, alcohol, and other drug use; (c) normative data on cannabis; (d) problems related to cannabis use; (e) potential costs and benefits of reducing cannabis use; (f) situational confidence in avoiding cannabis; and (g) life goals.

EFC. The EFC condition involved two highly structured didactic sessions, where the use of MET techniques was avoided.

The first session began by eliciting questions the participant had about cannabis and orienting the teen to the educational nature of the intervention. PowerPoint sections on Cannabis Basics, Cannabis and the Brain, and Cannabis and the Lungs were then reviewed. The second session consisted of reviewing the following PowerPoint presentations: Sex and Pregnancy, Cannabis and Driving, and The Heart. If time permitted in either session, the participant chose additional topics to review from the following content areas: The Legalization Debate, Cannabis and the World, Legal Issues, and Cannabis and Medicine.

Follow-Up Procedures

Follow-up assessments were scheduled 3-months and 12-months after the baseline assessment. Fourteen participants who were not available to complete the 12-month assessment in person (e.g., graduated seniors, dropouts, no longer in area, etc.) were offered the opportunity to complete an Internet-based assessment which mimicked the A-CASI program but did not include audio assistance. Participants received gift cards following each of the two intervention sessions (\$15), and after completing the 3-month (\$20) and 12-month (\$40) follow-up assessments.

Results

Preliminary Analyses

Although follow-up rates were excellent (98% at the 3-month follow-up and 91% at the 12-month follow-up), missing criterion scores (e.g., days of cannabis use, use-related problems, dependence symptoms) were replaced using an expectation-maximization procedure (Schafer & Graham, 2002). Findings from the primary outcome analyses for this study (Walker et al., in press) showed that, relative to DFC, both the MET and EFC conditions were associated with greater reductions in frequency of cannabis use and use-related problems at the 3-month follow-up. Frequency of cannabis use was significantly lower in the MET condition compared to the EFC condition, but the effect did not extend to differences in the number of cannabis dependence symptoms or use-related problems reported. At 12 months, reductions from baseline were maintained, but the MET and EFC conditions did not differ from one another on any of the criterion measures. Prior to combining participant data from the MET and EFC conditions for the present analyses, we tested whether intervention condition interacted with internalizing behavior problems, exter-

nalizing behavior problems, or any of the cannabis use motives when predicting either use-related problems or cannabis dependence symptoms at 3 months and 12 months. Out of the 28 interactions tested, only two were statistically significant. Condition interacted with the conformity motive in the prediction of cannabis problems reported at 3 months, $F(3, 201) = 5.25, p = .002$; $\beta = .17, p = .036$, and cannabis dependence symptoms reported at 12 months, $F(3, 201) = 2.06, p = .106$; $\beta = .20, p = .020$. In both interactions, increasing conformity motive scores were associated with greater problem and dependence symptom endorsement in the EFC condition relative to the MET condition. These unexpected findings were not explored further for the purposes of the present paper. The vast majority of analyses indicated that intervention condition did not moderate the relationships of cannabis motives or internalizing or externalizing behavior problems with cannabis use consequences and, as a result, the two treatment groups were combined for the following analyses.

Predicting Cannabis Use and Related Consequences

Table 1 shows the means and standard deviations of the predictors and the zero-order correlations among them. Significant moderate associations were evident between internalizing behavior problems and the coping motive, and between internalizing and externalizing behavior problems. The motive subscales showed small to moderate intercorrelations and associations with externalizing behavior problems. Table 2 shows means and standard deviations for the criterion measures and their zero-order correlations with the predictors. Surprisingly, there were almost no significant relationships between the predictors and the number of days of cannabis use, either concurrently or prospectively. Internalizing and externalizing behavior problems were positively associated with both cannabis problems and dependence symptoms at each time point. Among the cannabis use motives, coping showed the strongest and most consistent relationship with adverse consequences. More frequent engagement in coping motivated cannabis use was associated with greater numbers of problems and dependence symptoms. Social, conformity, and enhancement motives also predicted increased problem and dependence symptoms somewhat less strongly and less consistently across assessments. In general, compared to earlier time points, correlations between cannabis use motives and negative consequences were weakest at the 12-month assessment (see Table 2).

Next, we used hierarchical regression analyses to test whether motives for cannabis use contributed to the prediction of cannabis

Table 1
Zero-Order Correlations Among Cannabis Use Motives and Behavior Problems

| | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|------------------|------|------|-------|-------|-------|-------|-------|-------|---|
| 1. Coping | 1.99 | 0.91 | — | | | | | | |
| 2. Enhancement | 3.99 | 0.78 | .01 | — | | | | | |
| 3. Social | 2.61 | 0.89 | .23** | .33** | — | | | | |
| 4. Expansion | 2.01 | 0.98 | .27** | .31** | .37** | — | | | |
| 5. Conformity | 1.19 | 0.33 | .27** | -.05 | .32** | .08 | — | | |
| 6. Externalizing | 0.46 | 0.21 | .27** | .31** | .30** | .15* | .16* | — | |
| 7. Internalizing | 0.28 | 0.22 | .58** | .06 | .22** | .19** | .35** | .51** | — |

* $p < .05$. ** $p < .01$.

Table 2
Zero-Order Correlations of Predictors With Cannabis Use and Related Consequences

| | Baseline | | | 3-months | | | 12-months | | |
|---------------|---------------|---------------|-------------|---------------|---------------|-------------|---------------|---------------|-------------|
| | Days of CU | MPI | CDS | Days of CU | MPI | CDS | Days of CU | MPI | CDS |
| Mean (SD) | 38.97 (15.21) | 18.80 (12.87) | 3.41 (2.08) | 33.16 (19.73) | 14.46 (10.26) | 2.86 (2.01) | 33.97 (21.64) | 13.61 (10.32) | 2.83 (2.05) |
| Coping | -.01 | .46** | .45** | -.16* | .40** | .29** | -.13 | .18** | .19** |
| Enhancement | .12 | .07 | .10 | .07 | .13 | .15* | .03 | .13 | .16* |
| Social | .01 | .21** | .27** | -.02 | .21** | .24** | -.07 | .14* | .10 |
| Expansion | .01 | .16* | .16** | .03 | .24** | .16* | -.01 | .19** | .14 |
| Conformity | -.05 | .26** | .33** | -.04 | .23** | .16* | -.03 | .06 | .03 |
| Externalizing | .11 | .41** | .42** | .02 | .27** | .31** | .01 | .17* | .21** |
| Internalizing | .08 | .59** | .61** | -.12 | .44** | .36** | -.07 | .21** | .21** |

Note. CU = Cannabis use; MPI = Marijuana Problem Inventory; CDS = Cannabis dependence symptoms.
* $p < .05$. ** $p < .01$.

use consequence beyond demographic variables, concurrent substance use, and internalizing and externalizing behavior problems (see Table 3). Preliminary checks did not reveal significant multicollinearity among predictors. Cannabis use frequency was dropped as a criterion variable from these analyses based on the absence of bivariate relationships with predictors. Cannabis use-related problems and dependence symptoms served as the dependent measures for each assessment time point.

Age, gender, years of cannabis use, frequency of cannabis, alcohol, and other drug use, and condition were entered in Step 1 of the analyses. Internalizing and externalizing behavior problems were entered in Step 2. The five cannabis use motive subscales were entered, in Step 3. After all of the predictors were entered, the final regression analyses were significant at baseline, 3-months, and 12-months, for both cannabis use-related problems ($F(14,$

$188) = 11.42, p < .001; F(14, 188) = 7.94, p < .001; F(14, 188) = 6.51, p < .001$, respectively), and cannabis dependence symptoms ($F(14, 188) = 11.20, p < .001; F(14, 188) = 6.72, p < .001; F(14, 188) = 7.03, p < .001$, respectively). Of the control variables, days of cannabis use was the strongest and most robust predictor. The addition of externalizing and internalizing behavior problems in Step 2 explained significant additional variance at all time points. The standardized regression coefficients from the final models show that only internalizing behavior problems contributed unique predictive power. The set of cannabis use motives further incremented variance explained for the number of cannabis dependence symptoms at baseline and 12 months, and added significantly to the prediction of use-related problems at the 3 and 12-month assessments. The standardized regression coefficients indicated that using cannabis to cope accounted for unique varia-

Table 3
Regression Analyses Predicting Cannabis Related Consequences From Cannabis Use Motives and Behavior Problems

| | Baseline | | | | 3-Months | | | | 12-Months | | | |
|-----------------------------------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|
| | MPI | | CDS | | MPI | | CDS | | MPI | | CDS | |
| | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β |
| Step 1: Control variables | .19** | | .14** | | .17** | | .15** | | .24** | | .24** | |
| Age | | -.02 | | -.06 | | -.01 | | -.01 | | -.05 | | .02 |
| Gender | | .01 | | .01 | | .06 | | .04 | | .04 | | -.03 |
| Years of CU | | .06 | | .05 | | -.12 | | -.11 | | -.05 | | -.08 |
| Days of CU ^{ab} | | .18** | | .16** | | .33** | | .38** | | .47** | | .47** |
| Days of alcohol use ^{ab} | | -.06 | | -.04 | | -.01 | | -.02 | | .09 | | .06 |
| Days of OD use ^{ab} | | .16** | | .07 | | .09 | | .00 | | .03 | | .09 |
| Condition | | .05 | | .06 | | -.04 | | .08 | | .07 | | .07 |
| Step 2: Behavior problems | .24** | | .28** | | .15** | | .15** | | .04**† | | .06** | |
| Externalizing | | .13 | | .10 | | .03 | | .11 | | .02 | | .05 |
| Internalizing | | .33** | | .37** | | .27** | | .24** | | .09 | | .12 |
| Step 3: CU motives | .03 | | .04* | | .05** | | .04 | | .04*† | | .04* | |
| Coping | | .18** | | .15** | | .24** | | .18** | | .17** | | .21* |
| Enhancement | | -.03 | | .02 | | .06 | | .06 | | .05 | | .10 |
| Social | | .07 | | .09 | | .01 | | .12 | | .08 | | .03 |
| Expansion | | -.01 | | -.03 | | .05 | | -.04 | | .08 | | .01 |
| Conformity | | .05 | | .12 | | .06 | | -.01 | | -.04 | | -.06 |

Note. CU = cannabis use; OD = other drug; MPI = Marijuana Problem Inventory; CDS = cannabis dependence symptoms; $n = 203$.

^a Number of days of use out of the past 60 days. ^b Days of cannabis, alcohol, and other drug use in each analysis correspond to the time point of the criterion variable.

† MPI 12-month ΔR^2 values for Step 2 (.04) and 3 (.04) were significant at .01 and .05, respectively. * $p < .05$. ** $p < .01$.

tion in all of the regression analyses. None of the other motive scales contributed unique variance to the final regression models in these analyses.

Interaction of the Coping Motive and Behavior Problems Predicting Cannabis Related Consequences

Additional regression analyses were conducted to test whether interactive relationships existed between the coping motive and either internalizing or externalizing behavior problems. To eliminate nonessential multicollinearity, predictors were mean-centered prior to computing the interaction terms (Cohen, Cohen, West, & Aiken, 2003).

In order to test the hypothesis that using cannabis to cope would interact with internalizing behavior problems to predict cannabis use consequences, age, gender, years of cannabis use, frequency of cannabis, alcohol, and other drug use, and condition were entered in Step 1 of the analyses (see Table 4). Internalizing behavior problems and the coping motive were entered in Step 2, and the interaction of the two predictors was entered in Step 3. Cannabis related problems and dependence symptoms served as the dependent measures for each assessment time point.

The coping motive and internalizing behavior problem interaction entered in Step 3 of the analyses was not significantly associated with cannabis related problems at any time point (see Table 4). For cannabis dependence symptoms, the interaction was significant at each time point, baseline, 3-months, and 12-months ($\beta = -.13, p < .05$; $\beta = -.23, p < .01$; $\beta = -.15, p < .05$, respectively). Mean-centered coping motive scores were used to predict separate regression lines at the mean, and one standard deviation above and below the coping mean, in order to illustrate the interaction effects (Cohen et al., 2003). Figure 1 shows that individuals who endorsed high levels of internalizing behavior problems experienced a higher number of dependence symptoms, regardless of coping motive level. However, for those reporting

lower levels of internalizing behavior problems, greater coping motive scores were associated with a higher number of cannabis dependence symptoms.

The general regression model shown in Table 4 was also used to explore whether interactive effects existed for the coping motive and externalizing behavior problems; however, in Steps 2 and 3, the externalizing behavior problems predictor was entered in place of the internalizing behavior problems predictor. The externalizing x coping interaction term did not significantly predict either cannabis use-related problems or dependence symptoms at any time point.

Discussion

The present study extends research on motives for cannabis use to an adolescent population of cannabis users with clinically relevant use levels. Bivariate relationships showed that greater endorsement of most types of cannabis use motives predicted greater levels of cannabis use-related consequences, both cross-sectionally and prospectively. As expected, both internalizing and externalizing behavior problems were also associated with greater levels of negative consequences from cannabis use. Multivariate regression analyses showed that frequency of cannabis use, internalizing behavior problems, and the coping motive for cannabis use explained the most unique variance in cannabis consequences. Using cannabis to cope did not interact with internalizing behavior problems to predict even greater negative consequences; instead, using cannabis to cope appeared to matter most when internalizing behavior problems were less evident. There was no evidence that externalizing behaviors problems interacted with the coping motive in the prediction of negative consequences. These findings extend research on the importance of motives for cannabis use, particularly use of cannabis to cope with negative affect, to an adolescent population of heavy users, and have implications for treatment and intervention.

Table 4
Interaction of the Coping Motive and Internalizing Behavior Problems Predicting Cannabis Related Consequences

| | Baseline | | | | 3-Months | | | | 12-Months | | | |
|-----------------------------------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|--------------|---------|
| | MPI | | CDS | | MPI | | CDS | | MPI | | CDS | |
| | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β | ΔR^2 | β |
| Step 1: Control variables | .19** | | .14** | | .17** | | .15** | | .24** | | .24** | |
| Age | | -.03 | | -.06 | | -.01 | | -.03 | | -.06 | | .02 |
| Gender | | -.04 | | -.04 | | .03 | | -.01 | | .01 | | -.05 |
| Years of CU | | .06 | | .05 | | -.13 | | -.09 | | -.07 | | -.06 |
| Days of CU ^{ab} | | .18** | | .16** | | .34** | | .39** | | .47** | | .48** |
| Days of alcohol use ^{ab} | | -.05 | | -.06 | | -.01 | | .02 | | .10 | | .08 |
| Days of OD use ^{ab} | | .16** | | .07 | | .10 | | .01 | | .04 | | .07 |
| Condition | | .04 | | .05 | | -.05 | | .08 | | .06 | | .07 |
| Step 2: Interaction terms | .25** | | .29** | | .19** | | .16** | | .07** | | .08** | |
| Internalizing | | .43** | | .51** | | .32** | | .34** | | .12 | | .16* |
| Coping | | .20** | | .23** | | .28** | | .30** | | .22* | | .28** |
| Step 3: Interaction | .00 | | .01* | | .00 | | .04** | | .00 | | .02* | |
| Internalizing × coping | | -.01 | | -.13* | | -.05 | | -.23** | | -.04 | | -.15* |

Note. CU = cannabis use; OD = other drug; MPI = Marijuana Problem Inventory; CDS = cannabis dependence symptoms; $n = 203$.
^a Number of days of use out of the past 60 days. ^b Days of cannabis, alcohol, and other drug use in each analysis correspond to the time point of the criterion variable.
 * $p < .05$. ** $p < .01$.

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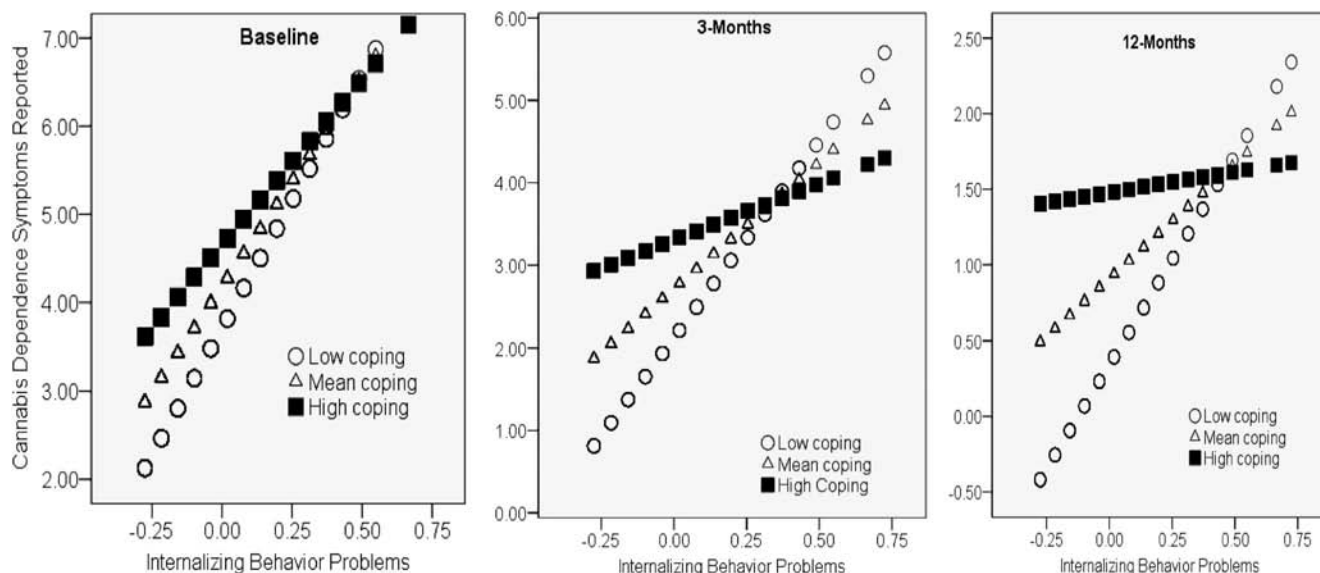


Figure 1. Interaction of internalizing behavior problems and the coping motive for cannabis use when predicting cannabis dependence symptoms at baseline, 3 and 12-months.

Four of the five cannabis use motives showed significant, if in some cases small, bivariate relationships with the negative consequences of cannabis use. Only the enhancement motive appeared unrelated to measures of problematic use. However, none of the cannabis use motives were associated with cannabis use frequency. Within nonclinical samples of less frequent users, cross-sectional associations between frequency of cannabis use and each cannabis motive domain have been reported (Bonn-Miller, Zvolensky et al., 2007; Zvolensky et al., 2007, 2009). In the current study, only individuals who had used cannabis on at least nine of the last 30 days were eligible to participate and, at baseline, participants had used 39 of the last 60 days on average. It is possible that relationships between cannabis use motives and frequency of use only become evident when the range of cannabis use is greater and includes very light or infrequent users.

Consistent with previous research (Brodbeck et al., 2007; Simons et al., 2005), both bivariate and multivariate results showed that using cannabis to cope with negative affect had the strongest and most robust relationships with negative use-related consequences. The predicted interaction between using cannabis to cope and internalizing behavior problems was found for cannabis dependence symptoms, but the form of the interaction was different than expected. It was predicted that using cannabis to cope in individuals experiencing high levels of internalizing problems would result in levels of negative consequences that exceeded the independent contributions of these predictors. Instead, high levels of internalizing behavior problems were associated with a higher number of dependence symptoms, regardless of coping motive level. Use of cannabis to cope contributed most when levels of internalizing problems were lower. Thus, cannabis users without internalizing behavior problems appear at greater risk for dependence symptoms when they use cannabis to cope with relatively transitory negative affective states and situations. The mechanisms through which the effects of using to cope yield greater symptoms of dependence in these users is unclear, especially because the

finding emerged in analyses that controlled for frequency of cannabis use. Given the unexpected nature of this finding, replication is needed, particularly because the interaction effect was not found for the index of problems related to cannabis use.

Nevertheless, these findings emphasize the importance of assessing the coping motive for cannabis use to help identify those at greatest risk for experiencing negative use-related outcomes. They also suggest that future intervention research should directly address this motivation for use. Cognitive-behavioral interventions for drug use typically include modules specifically addressing alternative means for dealing with negative affective states (Carroll, 1996; Larimer, Palmer, & Marlatt, 1999; Marlatt & Gordon, 2005), which could be emphasized for those frequently using cannabis to cope. Similarly, brief MET interventions may be strengthened if information on the prognostic importance of using cannabis to cope was integrated into the personalized feedback component of these interventions. The provision of feedback identifying coping motivated cannabis use as a risk factor for increased problems related to cannabis use may help motivate change.

Although primarily serving as control variables in the present analyses, both internalizing and externalizing behavior problems showed significant bivariate relationships with cannabis use-related consequences. However, in the multivariate regression analyses, only internalizing problems remained uniquely predictive of consequence indices. Further, externalizing behavior problems did not interact with the coping motive to produce even greater negative consequences. Previous research has generally found externalizing problems to be the more robust predictor of cannabis use frequency and severity (King et al., 2004; Winters et al., 2008). In this sample, externalizing behaviors were positively correlated with all of the motive subscales and with internalizing problems, suggesting that the loss of predictive power in the multivariate analyses was due to covariance with other predictors. The nature of the population may also partially explain the lack of robust findings for externalizing behavior problems. Heavy can-

nabis using adolescents may score in the higher range of externalizing behavior problems compared to the general population and the limited range in this variable may suppress relationships. In contrast, internalizing behavior problems were a robust predictor of dysfunctional cannabis use in this sample. Within the population of heavier cannabis users, it may be that variability in this dimension of behavior problems better adds to our understanding of negative consequences.

A limitation of the current study was the necessity of relying on cannabis use and adverse consequence data which was self-reported. Increasingly valid assessment information may have been obtained through biological assays and face-to-face assessment interviews, especially with respect to assessing cannabis dependence symptoms. However, in this case, the demands of conducting study appointments during the school day prohibited lengthy assessments and the collection of biological specimens. More intense assessment methods may also discourage adolescents from participating. Research has shown that ACASI assessment procedures may encourage more honest and accurate reporting of behaviors known to be socially unacceptable or undesirable compared to other assessment procedures (Metzger et al., 2000; Millstein, 1987).

In conclusion, the present findings show that research exploring cannabis use motives, and particularly the coping motive for use, has the potential to improve interventions and intervention outcomes for adolescent cannabis users. Motives for cannabis use can be assessed before treatment begins and provide information which can be targeted within counseling interventions. Tailoring portions of intervention content to personal information provided by the participant may also help to provide a relevant and engaging context that encourages change.

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Received July 30, 2010

Revision received April 15, 2011

Accepted April 20, 2011 ■