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## Willpower versus “Skillpower:” Examining How Self-Efficacy Works in Treatment for Marijuana Dependence

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### Abstract

Self-efficacy has repeatedly been demonstrated to be a robust predictor of outcomes in the treatment of marijuana use disorders. It is not clear, however, how increases in confidence in ability to refrain from use get translated into actual improvements in drug-related outcomes. Marlatt, among others, viewed the acquisition and use of coping skills as the key to behavior change, and self-efficacy as a cognitive state that enabled coping. But that model of behavior change has not been supported, and few studies have shown that the effects of self-efficacy are mediated by coping or by other processes. The current study combined three marijuana treatment trials comprising 901 patients to examine the relationships between self-efficacy, coping, and potential mediators, to determine if the effects of self-efficacy on outcomes could be explained. Results of multilevel models indicated that self-efficacy was a strong predictor of adaptive outcomes in all trials, even when no active treatment was provided. Tests of mediation showed that effects of self-efficacy on marijuana use and on marijuana-related problems were partially mediated by use of coping skills and by reductions in emotional distress, but that direct effects of self-efficacy remained largely unexplained. The results are seen as supportive of efforts to improve coping skills and reduce distress in marijuana treatment, but also suggest that additional research is required to discover what is actually occurring when substance use changes, and how self-efficacy enables those changes.

### Keywords

Marijuana use disorder treatment; self-efficacy; coping; mediation

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The term self-efficacy refers to having confidence in one’s ability to perform a given behavior in a given circumstance. This concept has become one of the most influential constructs in the addictions literature. In study after study self-efficacy has emerged as one of the most, if not the most, powerful predictors of treatment outcome (Kadden & Litt, 2011). In some sense, however, these results are not entirely explanatory. It is not clear, for example, just how increased “confidence” translates into improved outcomes. The purpose of the present study was to determine whether some other, more tangible, variables might help account for the effects of self-efficacy in a large sample of patients in treatment for

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marijuana dependence. That is, we sought to determine whether self-efficacy worked by simply enhancing “willpower,” or by some other means, particularly by increasing the likelihood of using coping resources, or “skill power,” as discussed by Marlatt (e.g., Marlatt & Gordon, 1985). A better understanding of what is being changed when we enhance self-efficacy may help us improve our treatments.

Although initially intended as a highly situation-specific cognitive variable, over time the concept of self-efficacy has been interpreted more generally, and is now commonly treated as a state variable (rather than a situation-specific one). In any case, the basic relationship posited by Bandura (1977) is still presumed to be true: self-efficacy expectancies will determine “whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences” (p. 191). Bandura’s conceptualization of how self-efficacy gets translated into behavior change suggested certain mediational constructs, namely coping behavior(s), and persistence, or motivation.

In much research in the addictions, however, potential mediators of the effects of self-efficacy seem to be left out. It is often not clear how self-efficacy gets translated into reduced substance use or prevention of relapse, a gap in our knowledge also noted by others (e.g., Maisto, Connors, & Zywiak, 2000). In recent literature regarding all areas of behavior change, including addictions, it seems to be assumed that simply the possession of self-efficacy is itself sufficient to alter behavior. In an earlier review of self-efficacy in the addictions (Kadden & Litt, 2011) we made note of research demonstrating that self-efficacy could act as a predictor and/or a mediator of outcomes. But no studies were found that identified true mediators of the effects of self-efficacy itself.

Since the Kadden and Litt (2011) review, other papers on self-efficacy have appeared, but most do not mention mediators of self-efficacy. For example, with respect to drinking, Witkiewitz, Donovan, and Hartzler (2012) found that self-efficacy significantly mediated the effects of drink refusal skills training on drinking outcomes, and Sugarman, Kaufman, Trucco, Brown, and Greenfield (2014) found that self-efficacy mediated the impact of alcohol severity on drinking outcomes. In a related area, Schuck, Otten, Kleinjan, Bricker, and Engels (2014) found that self-efficacy mediated the effect of smoking cessation counseling on abstinence at 12-months follow-up. With specific reference to cannabis, Connor, Gullo, Feeney, Kavanagh, and Young (2014) reported that refusal self-efficacy fully mediated the relationship between negative marijuana outcome expectancies and decreases in weekly consumption, and partially mediated the impact of positive expectancy on consumption.

However, none of these reports make any mention of mediation of the effects of self-efficacy. We found only two substance-abuse related papers in which mediation of self-efficacy is mentioned at all. A study on alcohol treatment by our group did posit a relationship between increases in coping self-efficacy and increases in cognitive and behavioral coping to predict reductions in drinking at posttreatment (Litt, Kadden, Cooney, & Kabela, 2003). Formal tests of mediation were not performed, however. Collins, Witkiewitz, and Larimer (2011) determined that intention to engage in risky drinking on the

part of college students mediated the effects of self-efficacy on risky drinking. However, this was a cross-sectional analysis, and the possibility that self-efficacy might have mediated the effect of intentions on drinking was not tested. Nor is it clear that the notion of “intentions” is any more explanatory than self-efficacy itself in terms of behavior change.

One study in which our group participated found that self-efficacy acted on outcomes in part through enhancing coping (Litt, Kadden, Stephens, & Marijuana Treatment Project Research Group, 2005). Structural equation models indicated that self-efficacy was strongly related to coping change, and that both were related to decreasing marijuana use over time. Measures of mediation were not significant, however, and even with coping in the model, self-efficacy was strongly and independently predictive of outcome over time.

Although the research in this area is sparse, there are a couple of avenues by which self-efficacy may influence substance use outcomes. We have already touched on the idea that high self-efficacy theoretically should translate into increased acquisition and use of coping skills. In addition, however, we might expect self-efficacy to have effects on other processes that influence use of marijuana. One of these processes is emotional distress.

Bandura (1982; 1986) theorized that those high in self-efficacy for a task would persevere, and would thus be more likely to achieve their goals, leading to improvements in mood. Improvement in distress levels would be the result of reinforcement for actual or perceived accomplishments. Other studies have indicated, however, that coping self-efficacy measured as a trait variable was predictive of less short and long-term distress following a natural disaster (Benight et al., 2015), and less fatigue and depression in cancer patients (Phillips & McAuley, 2013). Thus self-efficacy per se, that is, the sense of increased confidence itself, appears to be protective against distress, and may perhaps enhance positive mood. Given that emotional coping is a major motive for use of marijuana (Bonn-Miller, Zvolensky, & Bernstein, 2007; Zvolensky et al., 2007), it is likely that decreases in psychological distress would facilitate reductions in use.

To evaluate some of the possible mediators of self-efficacy on outcomes we combined three large samples of adult marijuana users in treatment. Mediation analyses were then conducted in which marijuana abstinence self-efficacy at the posttreatment time point was treated as the independent variable, marijuana use and marijuana problems measures were treated as outcomes, and measures of coping and psychological distress were treated as mediators.

Finally, some research has suggested that self-efficacy may develop and function differently for men and women. Davis and Jason (2005), for example, reported that women drinkers in treatment, but not men, tended to derive abstinence self-efficacy from sober social supports. Schunk and Lilly (1984) noted that women and girls are less likely than men to attribute performance successes to personal effort. To the extent that this is true women may not only report lower self-efficacy in abstinence contexts, but their self-efficacy reports may not translate as clearly as men’s into performance accomplishments (i.e., reducing substance use). Therefore, as a final exploration of the effects of self-efficacy on outcomes we examined the extent to which patient gender might have moderated any mediation relationships that emerge in these analyses..

## Method

### Participants

Participants were 901 patients treated in one of three clinical trials for marijuana dependence. All participants were recruited from the community through the use of newspaper and/or radio advertisements offering outpatient treatment. In the first trial, the Marijuana Treatment Project (MTP; Stephens, Babor, Kadden, Miller, & The Marijuana Treatment Project Research Group, 2002), participants were recruited from the greater metropolitan areas of Seattle, Hartford, and Miami. For the second and third trials that provided data for this study (MTP2 and MTP3), participants were recruited only from the greater Hartford area. For all trials, participants were eligible if they were 18 years of age or older and met DSM-IV diagnostic criteria for cannabis dependence during the 90 days prior to intake. Persons were excluded if they were dependent on other drugs (except nicotine) or on alcohol, unwilling to accept random assignment to treatment, currently receiving therapy or regularly attending a 12-Step group, or unable to provide a contact person who would be able to locate the individual for future follow-ups. Table 1 shows the demographic and baseline characteristics of the samples in the three marijuana treatment trials.

### Treatments Received

All patients randomized to treatment in each of the three trials were included in these analyses, even if they did not receive active treatment. The reasons for this are that all patients in these trials, regardless of treatment assignment, (1) had the experience of being in a treatment trial, (2) for the most part improved from pre- to posttreatment, and (3) pre-posttreatment changes in substance use reported by all of the patients in these trials were subject to similar effects of self-efficacy and mediation of self-efficacy effects. This was expected to be true even for those in the delayed treatment control condition in MTP, during the period in which they received no active treatment. In short, we were more interested in the processes determining treatment trial-related gains than in specific treatment effects.

MTP recruited 450 patients who were assigned randomly to either a 2-session motivational enhancement therapy (MET) condition, a 9-session treatment that combined MET with CBT and case management, or delayed treatment in which participants completed assessments at baseline and at the 4- and 9-month follow-ups, but received no treatment during the first 4 months. In MTP2, 238 participants were randomly assigned to one of four conditions: (1) Case Management that focused on life issues such as occupational, social, psychiatric, or educational concerns, (2) MET+CBT, which included the teaching of skills for coping with high risk situations, (3) Contingency Management (ContM) which provided reinforcement (vouchers redeemable for goods and services) contingent upon submitting drug-free urine samples; and (4) MET+CBT+ContM.

MTP3 was designed to test the efficacy of enhancing the completion of between-session homework assignments as a means of increasing coping skills acquisition. Participants (N=213) were assigned randomly to (1) MET+CBT+ContM-Homework, which paralleled MET+CBT treatment but with added delivery of reinforcements contingent upon engaging in homework activities, (2) MET+CBT+ContM-Abstinence, which was structured like the

first treatment but with reinforcements delivered contingent upon submitting drug-free urine samples, or (3) Case Management, an active control condition.

### Measures and Instruments

Patients in all three trials were administered a common set of instruments that were used in the present study to evaluate the mediation of self-efficacy on marijuana-related outcomes. Posttreatment assessments were administered at the completion of the treatment period in each trial: at 4 months in MTP, and at 2–3 months in the other two trials. Other follow-up periods occurred at 4–5 months, 8–9 months, 11 months (for MTP2 and MTP3), and 14–15 months post-intake. Marijuana outcomes at 8–9 months were used as the dependent variables in mediation analyses. Analyses of overall effects of self-efficacy on outcomes were conducted on all time points (see below).

#### **Dependent variables: Marijuana use and marijuana-related problems—**

Marijuana use was assessed using a Time Line Follow-Back (TLFB) interview (Sobell & Sobell, 1992) to reconstruct cannabis use for each of the 90 days prior to the baseline and follow-up interviews. Urine specimen results and collateral informant interview data both suggested that participants did not systematically underreport their use of marijuana (Marijuana Treatment Project Research Group, 2004). Two marijuana use variables were computed: continuous abstinence during each assessment period (yes – no), and proportion of days abstinent in the period (PDA). These variables did not take into account use of alcohol or drugs besides marijuana.

The Marijuana Problem Scale (MPS; Stephens, Wertz, & Roffman, 1993) is a 20-item self-report inventory that assesses negative social, occupational, physical, and personal consequences associated with cannabis use in the previous 90 days. Each item is scored on a three-point scale with 0=No problem, 1= Minor problem, and 2= Major problem. A MPS problem score is calculated by summing the items. In our samples the scale had an internal reliability  $\alpha = .81$ .

**Independent variable: Marijuana abstinence self-efficacy—**Self-efficacy for marijuana abstinence was assessed using a 20-item questionnaire developed by Stephens, Wertz, and Roffman (1993; 1995). Participants were asked to indicate on a 7-point scale their confidence in their ability to resist the temptation to smoke in a variety of interpersonal and intrapersonal situations. In our samples the internal consistency reliability exceeded  $\alpha = .90$ . Although the Marijuana Self-Efficacy Scale was administered at various times in the three trials, it was only consistently administered at pretreatment and posttreatment. Use of these time points allowed us to capture pre-posttreatment changes in self-efficacy, and to treat posttreatment self-efficacy (measured at months 2–4 depending on the trial) as the independent variable (IV) in the analyses of outcomes.

**Potential mediating variables—**Mediating variables were assessed at 4–5 months post intake. Coping was measured using the Coping Strategies Scale (CSS; Litt et al., 2005). The CSS is comprised of 48 items intended to tap potential coping strategies that might be used by patients to remain abstinent. Respondents rate the frequency (from 1 = never to 4 =

frequently) of using specific strategies in the previous 3 months. Although a number of subscales have been created for the CSS, the most reliable and predictive of the CSS scales is the Total Coping score, calculated by taking the mean across all 48 items (Litt, Kadden, & Tennen, 2012). The internal reliability of the CSS Total Coping score exceeded  $\alpha=.90$  across all trials. The CSS Total Coping score at 4–5 months was used as the coping mediating variable in the analyses that follow.

Psychological distress in the MTP study was assessed with the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI is among the best known measures of depressive symptoms. It consists of 21 items, utilizing a 0 to 3 scale to rate intensity of symptoms including depressed mood, pessimism, sense of failure, neurovegetative signs, and suicidal thoughts. Items are summed to give a total depression score (internal reliability  $\alpha=.86$ ). The Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983), a widely-used 53-item self-report scale, was used to assess gross changes in psychological functioning and distress in the MTP2 and MTP3 trials. The BSI total score was used as a Global Severity index. It was administered at baseline and at all follow-ups in MTP2 and MTP3. The Global Severity score had an average internal reliability of  $\alpha=.95$ . For both the BDI score and the BSI score the posttreatment values were used as the mediating variables.

A related construct, psychiatric problem severity, was assessed in all trials with the Addiction Severity Index (5th edition; McLellan et al., 1992) psychiatric severity subscale. The ASI is a semi-structured interview designed to address seven potential problem areas in substance-abusing patients: medical status, employment and support, drug use, alcohol use, legal status, family/social status, and psychiatric status. The instrument gathers information on recent (past 30 days) and lifetime problems in all of the problem areas. The psychiatric severity subscale assesses occurrence of severe instances of psychiatric disturbance, treatment for those problems, and disturbance caused by them. ASI psychiatric severity scores that were collected at 4–5 months served as mediating variables in the present study.

## Data Analysis

All analyses were conducted using SPSS, version 20.0 (IBM Corp., 2011). Effects of self-efficacy on outcomes across trials over time were examined to establish the general predictive ability of the construct. Overall treatment effects, and effects of self-efficacy over the three trials, were examined using multilevel linear models with maximum likelihood estimation for continuous dependent variables (PDA and MPS), employing Satterthwaite's approximation of degrees of freedom (Satterthwaite, 1946). In the multilevel models all effects were treated as fixed. Fixed effects were specified because the use of these provided better fit to the data (as measured by AIC) than when random effects were included, and because we had no hypotheses about relationships between predictors and outcomes over time differing by subjects. A strength of these analyses is that subjects' slopes over time are allowed to vary independently. Additionally, Subjects was treated as a random effect, allowing the intercept to vary randomly across participants (Hayes, 2006).

A generalized estimating equations (GEE) procedure with a binary logistic response model was used to evaluate abstinence (yes –no) for each follow-up period over time. For each

analysis the level 1 variable was time in months since the baseline assessment, out to 14–15 months. Level 2 variables were Trial (collapsed over individual treatments), and both baseline and posttreatment marijuana abstinence self-efficacy. We did not distinguish between intervention and control conditions because, as discussed above, we were not interested in treatment effects per se.

Mediation analyses were conducted to determine if attributions of self-efficacy got translated into cognitive, affective and/or behavioral changes that might directly influence marijuana-related outcomes. For these analyses we used outcome variables at 8–9 months post-intake as the dependent variables. This time point was chosen based on the observation that all marijuana outcomes appeared to have plateaued by this time point, and thus provided a reasonable representation of treatment-period effects. This extended time point, approximately 4 months after the assessment of the mediator variables, would also allow us to draw conclusions about temporal causality in the models.

As indicated above we were primarily interested in the possible mediating effects of coping, but also examined changes in measures of emotional distress as potential mediators of self-efficacy effects. Mediation analyses were conducted using Hayes' SPSS macro PROCESS (Hayes, 2012; Hayes, 2013), with 1,000 bootstrap resamplings. The procedure examines the effect of the independent variable (marijuana abstinence self-efficacy in these analyses) on the mediator (e.g., coping score at 4–5 months; the “a path”), the effect of the mediator on the outcome (the “b path”), and the indirect effect of self-efficacy on the outcome through its effects on the mediator (the “c' path”).

Marijuana abstinence self-efficacy at intake, and mediator variable scores at intake, were included as covariates in these analyses to help adjust for individual differences in intake levels and the effects of treatment. The scores of the outcome variables, assessed at intake, were tested in initial models as covariates, but were non-significant contributors, and were thus not included in the mediation models reported here. The basic mediation model is shown in Figure 1. The inclusion of the baseline values of the mediator variables as covariates had the effect of treating the mediator as a residualized change variable (i.e., posttreatment value corrected for baseline level). This method has the advantage of characterizing change without the problem of bias of initial (baseline) values (Cronbach & Furby, 1970; Hand & Taylor 1987). The effect of this approach is to test variables at follow-up while keeping initial values constant across subjects, thus getting a good estimate of changes occurring during a treatment interval.

The size and significance of the indirect effect was estimated, and tested using Sobel tests, yielding a z-test for conventional significance (Sobel, 1982). Additionally, point estimates and 95% bias-corrected bootstrapped confidence intervals (CI) were estimated. The indirect effect is considered statistically significant if the corresponding bootstrapped CI does not contain zero.

If more than a single mediator variable was found to be significant, tests of multiple mediation were conducted that included all those variables that showed significant mediating properties (significant indirect effects). The occurrence of multiple mediators

would suggest that the independent variable, self-efficacy, exerts its influence on outcomes via multiple pathways. Finally, all single mediation models were tested for moderation by patient gender.

## Results

### Examination of Overall Treatment and Self-Efficacy Effects

Mixed model analysis of PDA yielded a non-significant effect for treatment trial, and significant effects for Time [ $F_{(1, 3528.81)} = 484.45; p < .001$ ], and for both baseline [ $F_{(1, 752.23)} = 8.05; p < .005$ ] and posttreatment [ $F_{(1, 743.06)} = 341.06; p < .001$ ] values of marijuana abstinence self-efficacy respectively. Analysis of MPS yielded similar results, with a non-significant effect for Trial, and significant effects for Time [ $F_{(1, 3065.77)} = 612.65; p < .001$ ], and for both the baseline [ $F_{(1, 743.58)} = 34.97; p < .001$ ] and posttreatment values of self-efficacy [ $F_{(1, 732.51)} = 92.70; p < .001$ ]. GEE analysis of abstinence status over time indicated no significant between-Trial effect, a significant effect for Time (Wald  $\chi^2=90.36; p < .001$ ), no significant effect for baseline self-efficacy, and a significant effect for posttreatment self-efficacy (Wald  $\chi^2=343.10.36; p < .001$ ).

The influence of Time and marijuana self-efficacy on outcomes is illustrated in Figure 2. Outcomes are plotted by Trial and Time since baseline, and by self-efficacy level, high versus low. Self-efficacy level was determined by taking the median posttreatment self-efficacy score adjusted for baseline, and subtracting or adding 1 SD for thresholds for low and high levels. Medians and standard deviations were Trial-specific. As seen in the figure, all patients in all trials (in all treatment conditions) experienced gains from baseline to the 4–5 months point, but patients high in self-efficacy reported significantly better outcomes over time.

### Mediation of self-efficacy effects on outcomes

The results of the mediation analyses are shown in Table 2. As seen in the table, the influence of self-efficacy on PDA at months 8–9 was significantly mediated through its effects both on the CSS coping variable and on BDI depression score. Examination of the A path coefficients indicated that self-efficacy was predictive of increased coping and decreased BDI scores, which in turn were predictive of higher PDA (B paths). The effect of coping score was non-trivial, accounting for over 11% of the effect of self-efficacy on PDA.

Effects of self-efficacy on abstinence at 4–5 months were mediated by the CSS coping score, such that higher self-efficacy resulted in higher coping scores, which in turn led to greater levels of abstinence. The indirect effect of self-efficacy on abstinence through CSS score was only 7.3% however. In contrast to the analysis of PDA, no other variable emerged as a significant mediator of self-efficacy on abstinence outcome.

The effects of self-efficacy on MPS score at months 8–9 were mediated by several variables measuring psychological or emotional distress: BDI score or BSI score (depending on the trial), and the ASI Psychiatric Severity score. Increases in self-efficacy from baseline to the posttreatment time point were associated with decreases in all of the distress measures.

Decreases in distress were in turn associated with decrease in MPS scores at 8–9 months. Coping score, however, failed to mediate the effect of self-efficacy on the MPS score.

### Multiple mediators of self-efficacy effects on outcomes

Table 3 summarizes tests of multiple mediation of self-efficacy effects on PDA and MPS scores. As seen here, both CSS score and BDI score contributed significantly and independently to the mediation of self-efficacy effects on PDA. They did not totally account for the effects of self-efficacy, however. Even accounting for both CSS and BDI scores, the direct effect of abstinence self-efficacy on PDA was significant, and large ( $B = .006$ ;  $se = .001$ ;  $\beta = 0.485$ ;  $t = 9.722$ ;  $R^2 = .16$ ;  $p < .001$ ).

When multiple mediators were examined for the effects on MPS score, the BDI score again emerged as a significant mediator of self-efficacy effects. ASI psychiatric severity score dropped out in this analysis, however, probably due to its high correlation with BDI ( $r = .50$ ;  $p < .001$ ). Again, the addition of two mediating variables could not account for the total effect of self-efficacy on MPS scores. The direct effect of abstinence self-efficacy on MPS remained significant ( $B = -0.059$ ;  $se = 0.011$ ;  $\beta = -.293$ ;  $t = -5.16$ ;  $R^2 = .07$ ;  $p < .001$ ).

### Moderation of mediation effects by patient gender

Patient gender was entered as a moderator in each of the single mediation models described. In none of these models did gender emerge as a significant moderator of any of the mediation relationships. In short, men and women appeared very much alike in the extent to which their reports of self-efficacy predicted outcomes, and the degree to which coping or distress variables mediated the relationship between self-efficacy and outcomes.

## Discussion

The results demonstrate once again that self-efficacy plays a significant role in the prediction of treatment program-related gains in substance use. These gains occurred even in a waiting-list control group (in MTP, Trial 1 in this study). Regardless of treatment condition, those who increased most in self-efficacy had better outcomes that persisted for more than a year. The results also indicated that part of the effect of self-efficacy, at least on marijuana usage, was accounted for by increases in the use of coping skills, and to a smaller degree by decrease in emotional distress. These results are consistent with social learning theory in that increased self-efficacy should result in greater persistence at efforts to abstain, and in lower distress, as personal and treatment-related goals are met. These gains in persistence and reductions in distress should in turn lead to lower drug use and fewer problems related to use.

Our results also indicated, however, that only a portion of the effect on outcomes accounted for by self-efficacy could be explained by improvements in coping and distress. Indeed, in terms of PDA, the total coping score accounted for only about 11% of the total effect explained by self-efficacy (see Table 2). Baron and Kenny (1986) suggested that, at least in the behavioral sciences, complete mediation of effects would be rare, because there are so many variables that account for human behavior. In the present study it would seem that we are missing additional variables that might explain how increases in confidence get

translated into reduced use of marijuana. Use of coping skills was even a poorer predictor of 90-day abstinence than of PDA, indicating that even more missing variables may be implicated in producing abstinence rather than reduction of use. One conclusion is that most of the things that people are doing differently as a result of increased self-efficacy were not captured by our assessments.

In terms of accounting for marijuana-related problems, the results were somewhat more enlightening. Self-efficacy was a significant predictor of problems, and a sizable part of that effect was accounted for by reductions in distress, especially depression-related symptoms (See Table 3). This is not entirely surprising, given that the MPS is made up of several items reflecting emotional distress, including feelings of low self-esteem and feeling bad about using drugs. The correlations of the MPS score with BDI and BSI scores were  $r = .53$  and  $r = .25$  respectively. It is notable that coping score did not mediate the effects of self-efficacy on marijuana problems at the 8–9 month follow-up. It appears that skills that were intended to be used to help reduce use of marijuana did not translate into reduction of social, occupational, and physical problems later on. This may not be entirely surprising; a quick glance at our data indicate that marijuana use and problems only share at most about 20% of their variance.

Our examination of possible moderation of the mediating relationships by patient sex was also interesting. Our failure to find a moderated mediation suggest that women and men are much alike in their perceptions of self-efficacy, and in the ways in which self-efficacy, coping and distress operate to help determine substance use outcomes.

Despite the incomplete nature of the mediation of self-efficacy on outcomes, it is valuable that at least some mediation effect was found, especially for coping skills. Despite the promise of a model in which heightened confidence results in increases in coping efforts, this result has not always been found in previous studies. Although self-efficacy has been consistently predictive of treatment outcomes, the same has not been true of coping skills. For one thing, coping skills are often not measured. And even when coping skills are measured they have often failed to predict outcomes. This has been true in a number of studies, and not only in studies of marijuana treatment.

In a well-known example of the failure of coping skills to predict outcomes, Hawkins, Catalano, and Wells (1986) found that a skills training intervention for drug users produced significant improvement in skills related to avoiding drug use, coping with relapse, social interaction, problem solving, and coping with stress. At a 1-year follow-up, however, despite evidence of retention and generalization of skills, the skills measure did not predict drug use after treatment (Hawkins, Catalano, Gillmore, & Wells, 1989). Similarly, in a study of treatment for alcohol dependence, Ehret, Ghaidarov and LaBrie (2013) found that among those patients high in self-efficacy, behavioral strategies made no difference in terms of alcohol use or consequences. That is, a threshold level of self-efficacy was sufficient to account for improved outcomes regardless of the behavioral strategies used.

In part, our efforts to demonstrate “skillpower” as opposed to willpower may be limited by our methods. This is especially true of our ability to measure coping behaviors, as we have

mentioned elsewhere (Litt et al., 2012). Retrospective measures of coping behaviors most likely fail to capture the complexity of steps taken to reduce or eliminate substance use in unexpected high-risk situations, and over time as attitudes change. A measurement strategy that can highlight what people actually do differently on a momentary or daily basis will be necessary to refine our understanding of behavior change in these patients. We believe that daily monitoring (see Tennen, Affleck, Armeli, & Carney, 2000) and experience sampling (see, e.g., Litt, Kadden, & Kabela-Cormier, 2009) procedures hold promise to shed light on these behavior change processes.

Another limitation of approaches like those used here is that they assume a static, stepwise process of change, such that self-efficacy at time 1 should drive coping measured at time 2. Although we would expect such a sequence to occur, the processes are probably quite dynamic, and do not wait 3 or 6 months for us to measure them. It is likely that both self-efficacy and the use of coping skills change on a daily basis, and that while increased confidence should breed greater perseverance at coping, successful coping most likely also improves confidence.

The recursive effects of self-efficacy, mediators, and outcomes is mitigated to some extent in the present study by our use of baseline-value covariates for the independent variable self-efficacy and for the mediator variables, and by the use of outcomes that were measured 4 months after the mediators were assessed. The effects predicting the 8–9 month outcomes represent treatment period-related changes, and thus some temporal causality was preserved. That is, change *during the treatment period* predicted outcomes at extended follow-up. This was a strength of the present study.

As noted in our introduction, Marlatt was a strong believer in “skillpower;” the notion that behavior change results from the acquisition of skills to reduce substance use and resist relapse. In his model, self-efficacy is a cognitive condition that enables coping skills acquisition and use. The fact that in a number of studies self-efficacy appears to operate largely without the need for coping skills is a problem for our models of behavior change. The results presented here, as limited as they are, nevertheless indicate that attention to coping skills and to reducing emotional distress may be useful strategies in treatment of marijuana use disorders. But these results also indicate that we should be searching for those additional variables that mediate the effects of self-efficacy. We need to better understand what people are actually doing differently as a result of being more confident.

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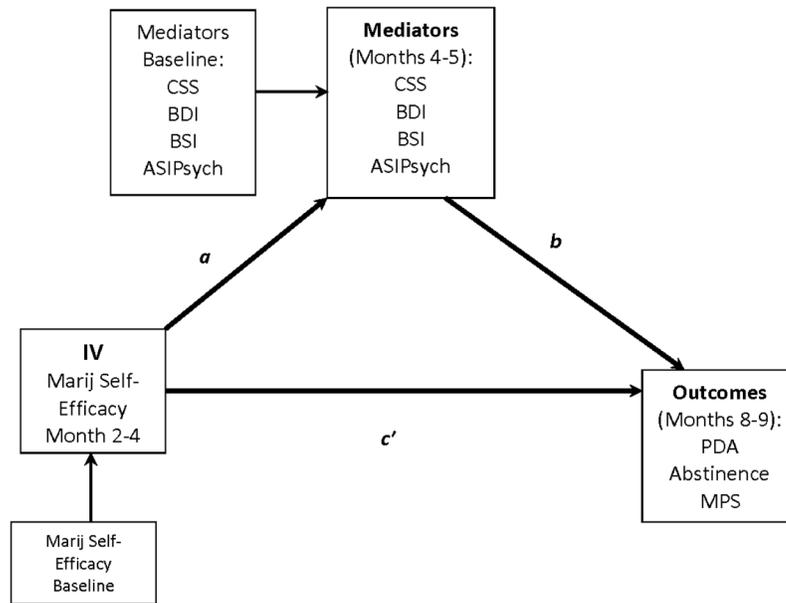
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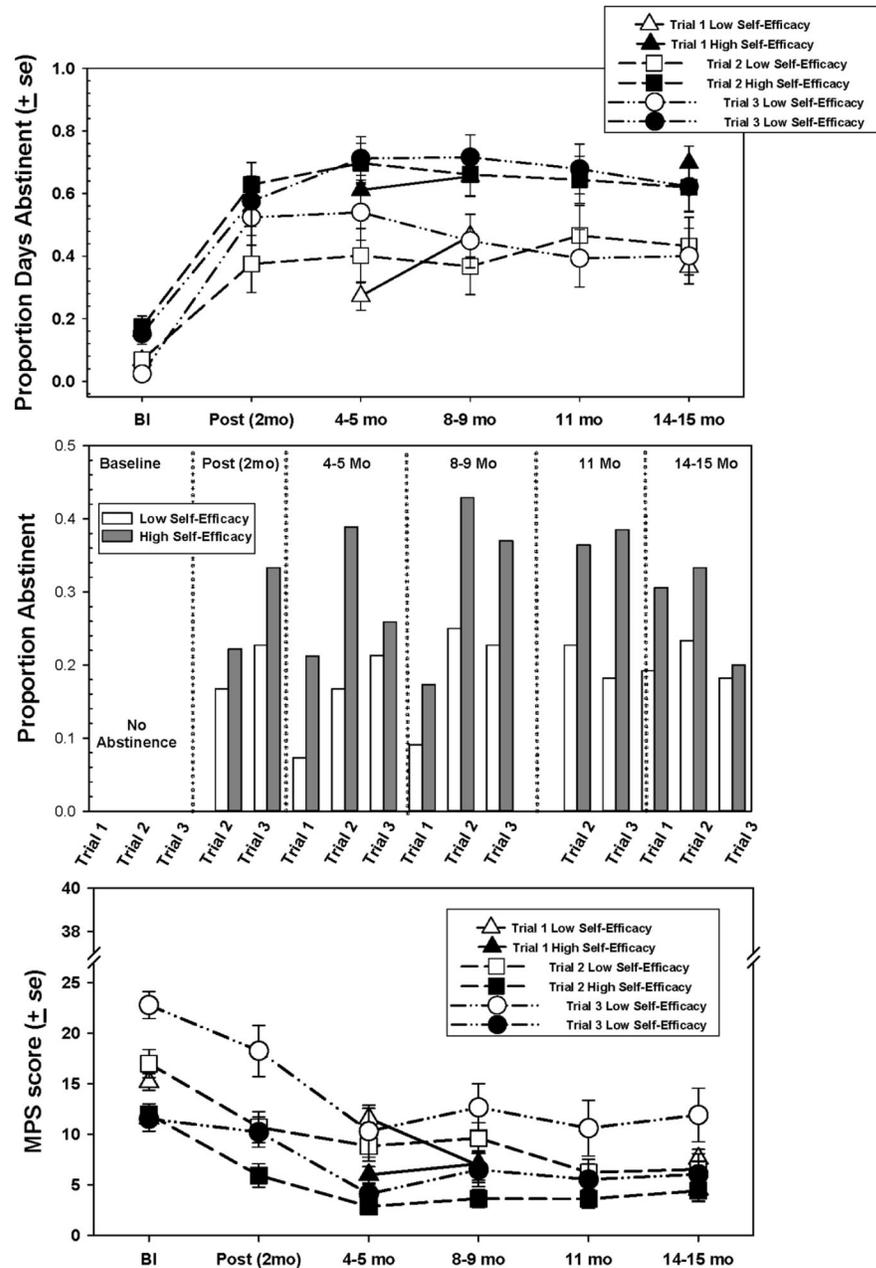
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**Figure 1.** Structural representation of the mediation design. The effect of self-efficacy on the outcome variables through the mediators is given by  $c'$ . Both the independent variable and the mediator variable are adjusted for baseline levels. Marij Self-Efficacy=Marijuana abstinence self-efficacy score; CSS=Coping Strategies Scale score; BDI=Beck Depression Inventory score; BSI=Brief Symptom Inventory score; ASIPsych=ASI Psychiatric Severity subscale score.



**Figure 2.** Marijuana-related dependent variables plotted by Trial and by self-efficacy level over time. Self-efficacy level was determined separately for each trial. In each of the panels data for Trial 1 were not collected for time periods Posttreatment (2months) or 11 months, and therefore no data points are depicted for Trial 1 at those time points.

**Table 1**

Background Characteristics of Samples Used in Analyses.

Variable	Trial			
	MTP (n=450)	MTP 2 (n=238)	MTP3 (n=213)	Total (N=901)
	Mean (SD) or %			
Sex (% Male)	69.3	70.6	68.1	69.4
Age (Years)	36.08* (8.34)	32.84 (9.60)	32.72 (10.06)	34.43 (9.25)
Married or Cohabiting (%)	40.2	39.9	35.2	39.0
Employed Full or Part Time (%)	83.1*	73.5	75.6	78.8
Education (Years)	14.04* (2.07)	12.95 (1.79)	13.17 (2.17)	13.55 (2.09)
Ethnicity (%)				
White	70.1	60.4	67.3	66.9
African American	12.1	18.8	12.1	13.9
Hispanic	17.3	15.0	17.3	16.7
Other	0.4	5.8	.3	2.6
Proportion Days Abstinent (Baseline)	.12 (.16)	.11 (.15)	.10 (.17)	.11 (.16)

Note:

\* MTP > MTP2, MTP3  $p < .05$ .

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**Table 2**  
Results of Analyses of Mediation of Self-Efficacy Effects on Marijuana-Related Dependent Variables.

Dependent Variable	Mediator	A Path			B Path			Indirect Effect			% Total Effect	N		
		Coeff	se	t	Coeff	se	t	Coeff	se	z			Lower 95%	Upper 95%
PDA	CSS	0.009	0.001	13.66***	0.084	0.027	3.09**	0.0007	0.0003	3.01**	0.0003	0.0012	11.3	583
8-9 Mo	BDI <sup>a</sup>	-0.029	0.013	-2.18*	-0.005	0.003	-2.08*	0.0002	0.0001	2.42*	0.0001	0.0004	2.3	410
	BSI <sup>b</sup>	-0.177	0.028	-6.25***	0.000	0.001	0.23	0.0001	0.0002	-0.23	-0.0005	0.0003	374	
	ASI Psych	-0.001	0.000	-4.40***	0.072	0.079	0.92	-0.0001	0.0001	-0.88	-0.0003	0.0001	424	
Abstinence	CSS	0.009	0.001	14.86***	0.501	0.224	2.09*	0.0037	0.0022	2.07*	0.0005	0.0081	7.3	549
8-9 Mo	BDI <sup>a</sup>	-0.065	0.009	-7.56***	0.002	0.272	0.06	-0.0001	0.0018	-0.06	-0.0037	0.0034	548	
	BSI <sup>b</sup>	-0.177	0.028	-6.24***	0.002	0.010	0.20	-0.0004	0.0021	-0.20	-0.0044	0.0039	352	
	ASI Psych	-0.001	0.000	-3.17***	0.105	0.802	0.13	-0.0001	0.0007	-0.13	-0.0016	0.0011	752	
MPS	CSS	0.009	0.001	12.47***	-0.999	0.633	-1.58	-0.0091	0.0057	-1.56	-0.0210	0.0014	547	
8-9 Mo	BDI <sup>a</sup>	-0.073	0.122	-6.00***	0.183	0.536	3.42***	-0.0134	0.0050	-2.94**	-0.2300	-0.0030	18.5	377
	BSI <sup>b</sup>	-0.177	0.030	-5.28***	0.054	0.192	2.81**	-0.0096	0.0041	-2.50*	-0.184	-0.026	14.2	328
	ASI Psych	-0.001	0.000	-4.06***	5.696	1.738	3.28**	-0.0061	0.0026	-2.50*	-0.0128	-0.0019	7.9	425

Note. A path = path from independent variable (self-efficacy) to mediator variable; B path = path from mediator variable to dependent variable; N = number of observations in analysis; Coeff = unstandardized coefficient; se = standard error; % Total Effect = Percent of Total Effect Mediated by Variable (for significant mediators only); PDA = Proportion Days Abstinent; 4-5 Mo = Months 4 to 5 after baseline; MPS = Marijuana Problems Scale score; CSS = Coping Strategies Scale total score; BDI = Beck Depression Inventory score; BSI = Brief Symptom Inventory total score; ASI Alc = Addiction Severity Index Alcohol Severity score; ASI Psych = Addiction Severity Index Psychiatric Severity score.

<sup>a</sup>BDI only used in Trial 1

<sup>b</sup>BSI only used in Trials 2 and 3

\*  $p < .05$ ;

\*\*  $p < .01$ ;

\*\*\*  $p < .001$

**Table 3**  
Results of Analyses of Multiple Mediation of Self-Efficacy Effects on PDA and MPS Outcomes.

Dependent Variable	Mediator	A Path			B Path			Indirect Effect			% Total Effect	N		
		Coeff	se	t	Coeff	se	t	Coeff	se	z			Lower 95%	Upper 95%
PDA	CSS	0.008	0.001	9.60***	0.070	0.033	2.09*	0.0005	0.0003	2.03*	0.0001	0.0011	8.3	506
8-9 Mo	BDI <sup>a</sup>	-0.069	0.010	-6.85***	-0.100	0.003	-0.37	-0.0001	-0.3600	0.72	-0.0004	0.0003		
MPS	BDI <sup>a</sup>	-0.071	0.012	-5.84***	0.175	0.063	2.79**	-0.0124	0.0055	-2.49*	-0.0232	-0.0010	17.0	377
8-9 Mo	ASI Psych	-0.001	0.000	-2.91**	0.949	2.170	0.44	-0.0010	0.0026	-0.41	-0.0070	0.0035		

Note. A path = path from independent variable (self-efficacy) to mediator variable; B path = path from mediator variable to dependent variable; N = number of observations in analysis; Coeff = unstandardized coefficient; se = standard error; % Total Effect = Percent of Total Effect Mediated by Variables; PDA = Proportion Days Abstinent; 4-5 Mo = Months 4 to 5 after baseline; MPS = Marijuana Problems Scale score; CSS = Coping Strategies Scale total score; BDI = Beck Depression Inventory score; ASI = Brief Symptom Inventory total score; ASI Alc = Addiction Severity Index Alcohol Severity score; ASI Psych = Addiction Severity Index Psychiatric Severity score.

<sup>a</sup>BDI only used in Trial 1

\*  $p < .05$ ;

\*\*  $p < .01$ ;

\*\*\*  $p < .001$