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Motivational and mindfulness intervention for young adult female marijuana users

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Abstract

This pilot study tested the efficacy of a brief intervention using motivational interviewing (MI) plus mindfulness meditation (MM) to reduce marijuana use among young adult female. Thirty-four female marijuana users between the ages of 18–29 were randomized to either the intervention group (n = 22), consisting of 2 sessions of MI-MM or an assessment-only control group (n = 12). Participants' marijuana use was assessed at baseline, 1, 2, and 3 months post-treatment. Fixed-effects regression modeling was used to analyze treatment effects. Participants randomized to the intervention group were found to use marijuana on 6.15 (z = -2.42, p=.015), 7.81 (z = -2.78, p=.005), and 6.83 (z = -2.23, p=.026) fewer days at months 1, 2, and 3, respectively, than controls. Findings from this pilot study provide preliminary evidence for the feasibility and effectiveness of a brief MI-MM for young adult female marijuana users.

Keywords

Marijuana; Females; Mindfulness; Motivational Enhancement; Anxiety

1. Introduction

Marijuana is the most widely used illicit substance in the United States. In 2009, approximately 6.6% (16.7 million) of Americans over the age of 12 reported using marijuana at least once in the past month (SAMHSA, 2010). Regular marijuana use is associated with respiratory illnesses such as bronchitis, emphysema, and lung infections (Brook, Stimmel, Zhang, & Brook, 2008; Moore, Augustson, Moser, & Budney, 2005; Tashkin, 2005), as well as neuro-cognitive deficits (Brook et al., 2008; Solowij et al., 2002). The use of marijuana has also been linked with psychosocial problems including occupational absenteeism, work-related accidents (Lehman & Simpson, 1992; Zwerling, Ryan, & Orav, 1990), poor educational achievement (Brook et al., 2008; Fergusson,

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Horwood, Beautrais, 2003; Lynskey & Hall, 2000), and increased likelihood of mental health conditions, including anxiety, depression and suicidal behavior (Brook et al., 2008; Fergusson et al., 2002; King et al., 2001). Given these associations and the high prevalence of use, marijuana use represents a significant public health problem.

In 2009, young adults between the ages of 18 and 25 had the highest rate of marijuana use, with approximately 18.1% reporting use at least once in the past month (SAMHSA, 2010). This rate is a significant increase from the previous two years (2007- 16.5%; 2008-16.4%) indicating an upward trend in marijuana use among young adults. Not surprisingly, marijuana users of this age group have been the focus of research and clinical efforts aimed at understanding, reducing, and treating substance use. However, studies focusing on young adult marijuana users have struggled to recruit women (Fattore, Fadda, & Fratta, 2009). Knowledge regarding marijuana use in this group is important because use is highly prevalent in women between the ages of 18 and 25 and may pose unique risks. In addition to the potential negative consequences of marijuana use noted above, marijuana use among females has also been linked to increased sexual activity, inconsistent condom use, and greater levels of sexual activity while under the influence (De Genna, Cornelius, & Cook, 2007; Poulin, & Graham, 2001). These types of sexually risky behaviors increase a woman's risk for unplanned pregnancies and the contraction of sexually transmitted diseases. Taken together, the risks associated with marijuana use represent a significant threat to the health and well-being of women in the early stages of adulthood.

1.1. Motivational Enhancement

Motivational interventions (MI), with their limited contact time, cost effectiveness, and client-centered approach, are a promising treatment for marijuana users (Miller & Rollnick, 2002). Moreover, MI has been shown to be particularly effective at reducing marijuana use among adolescents and young adults. In a study of weekly marijuana users between the ages of 16 and 20, McCambridge & Strang (2004) demonstrated that a single motivational session significantly reduced marijuana use at 3-month follow-up. In another study testing a brief *Marijuana CheckUp*, Walker and colleagues (2006) also found MI decreased marijuana use among 97 adolescents at 3-month follow-up. In a larger trial (N=188) targeting young adult marijuana users with a brief MI, Stephens and colleagues (2007) found that MI participants had fewer marijuana use days at 12 months (effect size of .45) compared to either a delayed feedback or an educational control condition.

Findings from these studies served as the basis for our recently completed randomized clinical trial of a brief MI for young adult female marijuana users with varying levels of quitting desire (Project MAPLE). In this study, 332 women between the ages of 18–24 were randomized to either a two-session motivationally-focused intervention or an assessment only condition. Our findings showed that the intervention's effect on marijuana use was not statistically significant at 1-month (OR = 0.77, $p = .17$), significant at 3-months (OR = 0.53, $p = .01$), and no longer significant at 6-months (OR = .74; $p = .20$). However, among the 61% of participants endorsing any desire to quit using marijuana at baseline, the MI intervention was found to have a significantly greater reductive effect on the likelihood of marijuana use at 1- (OR = 0.42, $p = .03$), 3- (OR = 0.31, $p = .02$), and 6-months (OR = 0.35, $p = .03$) indicating that MI provided the greatest overall reduction and sustained reduction for women with a desire to quit (Stein, et al., In Press).

1.2. Anxiety and Marijuana Use

In a secondary analysis of *Project MAPLE* (de Dios, et al., 2010a), we illustrated the connection between anxiety reduction and marijuana use. We found that 89% of our sample endorsed at least one symptom of general anxiety disorder (GAD), and among those

expressing any desire to quit, 93% reported that they used marijuana to help them relax, 84% to relieve anxiety, and 88% to help them be “calm”. Furthermore, these tension reduction and relaxation motives were found to significantly mediate the relationship between GAD symptoms and marijuana use (de Dios et al., 2010a). These findings are consistent with previous studies that have established an association between anxiety disorders and marijuana use (Andrews, Hall, Teeson, Henderson, 1999; Burns & Teesson, 2002; Grant, et al., 2004; Teeson, Hall, Lynskey, Degenhardt, 2000). Using data from the National Comorbidity Study, Agosti, Nunes, and Levin (2002) showed that individuals meeting criteria for cannabis dependence were twice as likely to also have a co-morbid anxiety disorder diagnosis. Studies examining the relationship between marijuana use and anxiety-related symptoms and constructs have also yielded significant associations between marijuana use and agoraphobic cognitions (Bonn-Miller, Zvolensky, Bernstein, & Stickle, 2008), anxiety arousal (Bonn-Miller et al., 2008), affective lability (Simons et al., 2005), negative affect (Zvolensky et al., 2007), worry (Bonn-Miller, Zvolensky, & Bernstein, 2007) and anxiety sensitivity (Buckner et al., 2011). Such findings support the notion that individuals experiencing anxiety symptoms use marijuana as a method for coping (Bonn-Miller, Zvolensky, & Bernstein, 2007).

Given these associations and the results of *Project MAPLE*, we sought to develop and test an intervention that addressed the phenomenon of marijuana use as a way to relieve anxiety-related symptoms among young adult female marijuana users. Specifically, we blended our *Project MAPLE* intervention with mindfulness-based components, with the aim of providing young women with an alternative for coping with distressing negative affective states.

1.3. Mindfulness-Based Meditation

Mindfulness-based meditation, which is derived from Buddhist meditation practices, made its first inroads into medical care in the form of Mindfulness-Based Stress Reduction (MBSR) in 1979 (Kabat-Zinn, 1990). Today, mindfulness-based approaches have proliferated and include Mindfulness-Based Cognitive Therapy (Segal, Williams, & Teasdale, 2002), Acceptance and Commitment Therapy (ACT; Hayes, Strosahl & Wilson, 2003), Dialectical Behavioral Therapy (DBT; Linehan, 1993), Mindfulness-Based Relapse Prevention (MBRP; Witkiewitz, Marlatt & Walker, 2005) and Mindfulness-Based Therapeutic Community treatment (MBTC; Marcus & Zgierska, 2009). The basis for mindfulness-based approaches is the cultivation of a nonjudgmental awareness, curiosity, openness and acceptance of internal and external experiences, with the intended goal of eliciting greater reflection and acceptance, especially in regard to negative affect (Praisman, 2008).

Mindfulness-based approaches have been applied to the treatment of a number of psychological problems including anxiety and substance use, and numerous studies have demonstrated the efficacy of mindfulness-based interventions in reducing anxiety symptoms (Arch & Craske, 2010; Campbell-Sills, Barlow, Brown, & Hofman, 2006; Carmody & Baer, 2008; Kabat-Zinn et al., 1992; Kim et al., 2009; Miller, 2010) and other negative emotional states such as depression, worry and rumination (Grossman, Nieman, Schmidt, & Walach, 2004; Jain et al., 2007; Teasdale et al., 2000; Witek-Janusek et al., 2008). The success of mindfulness-based approaches in reducing anxiety and negative affective states is attributed to the intervention's focus on training present-moment awareness which cultivates a more experiential, accepting, and non-judgmental relationship to negative thoughts and feelings. Rather than focus directly on negative affect reduction, mindfulness seeks to diminish the escalation of negative emotional reactivity (secondary negative affect in reaction to transient negative emotion) during stressful periods. From a behavioral and cognitive perspective, this

mechanism of action is synonymous with extinction learning and improved attentional capacities (Treanor, 2011).

Mindfulness-based approaches have been successfully applied to the treatment of substance abuse and addiction (See Zgierska, et al., 2009 for Review; Bowen et al., 2009; Brewer et al., 2009; Britton et al., 2010; Liehr et al., 2010; Marcus & Zgierska, 2009; Marcus et al., 2009; Vieten, Astin, Buscemi, & Galloway 2010; Zgierska & Marcus, 2010). The efficacy of mindfulness-based approaches in substance abuse treatment is attributed to decreasing the impact of negative affect. Such negative affect reactivity is thought to serve as a trigger for substance use and improving distress tolerance is an important target of mindfulness-based substance abuse treatment (Sinha, 2007). In behavioral terms, mindfulness-based approaches for substance abuse are described as a process of desensitization to negative affect through exposure which helps to extinguish automatic avoidance of negative emotions and consequential substance use.

A key component of all mindfulness-based approaches is teaching a *breath awareness meditation* which is a guided exercise that increases mindful attention on the breath as well as develops a nonjudgmental awareness of cognitions, thoughts, and distractions that may emerge during the meditation (Zeidan, Gordon, Merchant, & Goolkasian, 2009). Brief mindfulness inductions, (10–20 minutes in 1–2 sessions) have been used as experimental manipulations of both acute urge management and acute anxiety or emotional reactivity (Arch & Craske, 2006; Campbell-Sills, Barlow, Brown, & Hofman, 2006). In a recent pilot study, Bowen and Marlatt (2009) found that as little as one 1.5 hour session of mindfulness training resulted in decreases in tobacco use, suggesting that brief mindfulness training can be effective as an intervention.

In the current randomized pilot trial, we sought to augment our brief efficacious motivational intervention from *Project MAPLE* by including key components of mindfulness-based meditation with the aim of providing young women with an alternative method (replacing marijuana use) for coping with distressing negative affective states. We hypothesize that women randomized to the blended motivational intervention plus mindfulness meditation (MI-MM) group will show greater reductions in days of marijuana use as compared to the assessment only (AO) control group. Furthermore, among our MI-MM group, we hypothesize that engaging in meditation on a given day will be associated with a significant decrease in the probability of using marijuana on that day.

2. Materials and Methods

2.1. Study Design and Procedures

The study sample was recruited from the community through newspaper and radio advertisements. Women responding to the ads were screened for eligibility with a brief phone interview, and if interested, were scheduled for a comprehensive assessment where informed consent was obtained. Eligible persons were enrolled in a randomized clinical trial (CAMEO) to reduce marijuana use which compared a 2-session blended MI-MM to an AO control group.

Between March and August of 2010, 153 individuals were screened over the phone. Inclusion criteria included: 1) smoked marijuana at least 3 times in the past month, 2) female, 3) between the ages of 18–29, 4) lived within 20 miles of Providence RI and planning to remain in the geographic area for the next 3 months, 5) speak English, 6) endorsed a desire to quit or reduce their marijuana use, and 7) used marijuana as a way to relax, relieve anxiety, or calm down (endorsed the following item derived from the Marijuana Expectancies Questionnaire - *In the past month, have you used marijuana as a*

way to relax, relieve anxiety, or calm down?). Exclusion criteria included having a severe psychiatric disorder/s that would interfere with treatment (e.g., schizophrenia, untreated bipolar disorder, or PTSD), using alcohol or other substances at high levels (>7 alcohol drinks per week in the past month [NIAAA criteria for *Hazardous Use*]), and using any cocaine, heroin, methamphetamines or other drugs in the past month.

Of those screened, 75 were excluded for not meeting eligibility criteria for the following reasons: had not smoked marijuana at least 3 times in the last month (n=8); did not use marijuana to relax (n=1); did not have a desire to quit or reduce marijuana (n=22); used alcohol or other substances at high levels (n=14); had a psychiatric disorder that would interfere with treatment (n=21); or did not meet secondary study criteria (e.g., age, English comprehension, planning to stay in area, n=9). Of the 78 eligible women, 36 never attended the baseline appointment and were not enrolled in the study. Of the 42 women who provided informed consent, 8 were determined to be ineligible during the baseline assessment. The final sample included a total of 34 women. All 34 women attended at least one treatment session and all were included in our analyses. Our approach for handling missing data is described further in the *Analysis* section.

Following the baseline assessment, participants were randomized to the MI-MM condition or the assessment-only (AO) condition in a 2:1 ratio. A 2:1 ratio was used in order to optimize the interventionist's experience in delivering the intervention and to ensure adequate numbers of MI-MM participants after accounting for the potential for drop out. Research assistants performing the assessments were blinded to assigned condition. All women were scheduled for follow-up assessment at 2 weeks (end of treatment phase), 1-month and 3-months following the baseline assessment. For each MI-MM participant, two individual sessions were scheduled, each lasting approximately 45 minutes. The initial MI-MM session was conducted on the same day immediately following the baseline assessment; the second MI-MM session was scheduled for two weeks later. Participants assigned to AO completed baseline, 2 weeks, 1-month and 3-months assessment visits only. Participants were compensated for attending all study assessment visits. The protocol was approved by the Institutional Review Board of Butler Hospital.

2.2. MI-MM Intervention

The MI-MM intervention included the core components of the MI intervention of *Project MAPLE* (See Stein et al., In Press, for a full description of this brief motivational intervention) as well as mindfulness-based meditation components derived from the approaches of Kabat-Zinn (1990) and Segal, Williams, & Teasdale, (2002).

2.2.1. Mindfulness Components of Session 1—During Session 1, mindfulness-based meditation was introduced to participants as a possible alternative for coping with negative affect. Participants and the interventionist engaged in a brief mindfulness meditation experiential exercise (approximately 5 minutes long) which was guided by an audio CD. Following this exercise, both the participant and the interventionist discussed their mental (or cognitive) and physical experience during the meditation exercise. The interventionist made an effort to normalize the experience of intrusive thoughts, particularly anxiety-related thoughts such as worry and rumination. Following this discussion, the interventionist presented an overview of mindfulness-related concepts including maintaining a non-judgmental and present-focused mental state and engendering greater awareness of one's thoughts, feelings, reactions as well as one's environment and stressors. Session 1, concluded with a longer meditation exercise (approximately 15 minutes long) that was followed by a discussion which focused on applying the mindfulness concepts to the meditation experience. Participants were given an audio CD to take home and use as a daily

practice. The audio CD consisted of the two guided meditation exercises from the session. Participants were encouraged to use the CD and to keep a diary of their use of the CD, experiences, and marijuana use. The daily diary form consisted of 2 categorical fields (*yes/no*) that participants completed to indicate whether they used marijuana and whether they used the meditation CD. The “Experience” portion of the diary was open-ended and participants wrote in long form any ideas, thoughts, or experiences that may be relevant to marijuana use, mindfulness concepts, anxiety, etc.

2.2.2. Mindfulness Components of Session 2—During Session 2, participants were asked to discuss their experience in the past two weeks with the meditation exercises and the application of the mindfulness concepts. The interventionist acknowledged and praised efforts that were made. The interventionist also led a discussion about the positive effects of meditation and normalized the experience of slow progress. The interventionist and the participant also engaged in a problem-solving discussion about the barriers to practicing meditation and applying the mindfulness concepts to daily life. In addition, the interventionist discussed the connection between anxiety, stress, worry, and marijuana use and reiterated mindfulness concepts and approaches that may benefit the participant in dealing with anxiety related symptoms.

2.2.3. Interventionist Training—Intervention sessions were performed by master’s level interventionists. Study interventionists were trained in mindfulness meditation by an experienced, certified instructor of (MBSR). Training consisted of multiple didactic training sessions, directed readings, experiential exercises in meditation, role plays, test cases and ongoing support and supervision. The study interventionists were experienced in delivering MI. All sessions were audio recorded and reviewed for MI and MM fidelity/adherence in biweekly supervision sessions with a licensed clinical psychologist.

2.3. Measures

Demographic characteristics assessed at baseline included age, race/ethnicity, and employment status. Past 90-day marijuana and other substance use was assessed using the valid and reliable Timeline Follow Back (TLFB; Sobell & Sobell, 1992). TLFB reports of marijuana abstinence were biologically confirmed using urine analyses at all follow-up visits. Meditation practice was also assessed at all three follow-up assessments as part of the TLFB. In addition to the standard TLFB questions about substance use, participants were asked to recall whether or not they meditated on each calendar day. In addition, participants were asked to keep a daily diary of marijuana use and meditation practices. Research assistants intended to use the diaries as a way to corroborate TLFB reports. However, only 3 (13.6%) MI-MM participants remembered to bring the diary to any of the study visits. Therefore, confirmation of TLFB reports using the diary was only conducted with those 3 MI-MM participants.

At the baseline assessment, generalized anxiety disorder (GAD) symptoms in the past 6 months were assessed using the Psychiatric Diagnostic Screening Questionnaire (PDSQ) (Zimmerman & Mattia, 2001). The PDSQ is a brief self-report scale designed to screen for the most common DSM-IV Axis I disorders. In the current study, we used the GAD subscale of the PDSQ, which consists of 10 GAD symptoms based on DSM criteria, to derive a GAD symptom count score. The GAD subscale of the PDSQ has been shown to have good internal consistency ($\alpha = .89$), test retest reliability (reliability coefficient = .79), and adequate convergent validity (.67) with clinician diagnosis (Zimmerman & Mattia, 2001). A PDSQ-GAD cutoff score of 4 is recommended for obtaining optimal sensitivity and specificity for GAD diagnosis (Zimmerman & Mattia, 2001).

2.4. Analysis

We present t-tests and χ^2 -tests to compare intervention groups on background characteristics, baseline marijuana use frequency, and study attrition. The Wilcoxon rank-sum test and Fisher's exact test were evaluated to confirm these results. We used the fixed-effects estimator to estimate treatment effects at 1-, 2-, and 3-months. The fixed-effect estimator effectively controls for between subject differences by estimating a fixed-effect (analogous to including a separate dummy variable for each subject) for each subject (Rabe-Hesketh & Skrondal, 2005). Another advantage of this approach is that it uses all available information and provides unbiased estimates when data are missing at random or missing completely at random. As a further check on the degree to which our findings might be sensitive to attrition we replicated the analysis using the method of carrying forward the value of the last valid observation. We used bias-corrected, bootstrapped 95% confidence intervals with 1,000 re-samplings, which require no model-based distributional assumptions and can be used when sample sizes are not sufficient to justify reliance on large sample inferential statistics (Mooney & Duval, 1993). We considered 95% confidence interval estimates that exclude 0 to be statistically significant at the .05 level. We also used fixed-effects logistic regression to estimate the subject specific association between daily meditation and marijuana use. Here, the unit of analysis is the person-day and we restricted the analysis to participants randomized to the intervention.

3. RESULTS

3.1. Baseline Characteristics

Participant characteristics are summarized in Table 1. The average age of the sample was 23.0 (± 2.9) years-of-age. Seventeen participants (50.0%) were non-Hispanic Caucasians, 11 (32.4%) were African-American, 2 (5.9%) were Hispanic, and 4 (11.8%) were of other racial or ethnic origins. Eighteen participants (52.9%) were employed either full- or part-time. The intervention groups were not significantly different with respect to age ($t_{32} = 0.69$, $p = .494$), ethnicity ($\chi^2 = 5.52$, $df = 3$, $p = .137$), or employment status ($\chi^2 = 0.06$, $df = 1$, $p = .800$).

On average participants reported using marijuana on 17.7 (± 9.3) of the 30-days prior to baseline assessment. Mean rate of marijuana use days among control group participants was 18.8 (± 8.1) and 17.0 (± 9.96) among participants in the intervention group; between-group differences were not statistically significant ($t = 0.53$, $p = .598$).

On average, participants reported 5.59 (± 2.98) PDSQ-GAD symptoms at baseline. Participants in the MI-MM intervention averaged 5.95 (± 2.90) GAD symptoms at baseline and those in the control group averaged 4.92 (± 3.12). Between-group differences in baseline PDSQ GAD symptom count score were not statistically significant ($t = -0.97$, $p = .339$). All 34 participants reported at least one PDSQ-GAD symptom. A total of 25 (73.5%) of the 34 participants breached the PDSQ-GAD diagnostic clinical cutoff.

3.2. Follow-Up, Attrition, and Treatment Adherence

As summarized in Table 1, in total, 20.7%, 23.5%, and 26.5% participants were lost to follow-up at 1-, 2-, and 3-months, respectively; 79.3% were located for at least 1 follow-up assessment. Between-group differences in attrition were not significant at 1- ($\chi^2 = 0.17$, $df = 1$, $p = .676$), 2- ($\chi^2 = 0.49$, $df = 1$, $p = .486$), or 3-month ($\chi^2 = 0.02$, $df = 1$, $p = .886$) follow-up. Demographic characteristics and marijuana use frequency did not significantly predict study attrition. Among women randomized to the MI-MM intervention ($n=22$), 100% attended the first session and 73% ($n=16$) attended the second intervention session.

3.3. Marijuana Use Outcomes

Subject-specific estimates of the effects of intervention on days using marijuana at follow-up are given in Table 2. Coefficients for time give the expected change in marijuana use frequency between baseline and each follow-up for controls. These coefficients were substantively small and none were statistically significant. On average, controls were estimated to reduce marijuana use by 1.2 (95% CI -4.16; 2.00) days between baseline and 1-month, but had slightly higher average marijuana use frequency at both 2- (b = .2, 95% CI -2.67; 3.71) and 3-months (b = 0.79, 95% CI -3.24; 5.15). The effect of intervention is estimated as the treatment-by-time interaction terms. Compared to controls, those randomized to the intervention were estimated to have significantly less frequent marijuana use during follow-up (Wald $\chi^2 = 8.89$, df = 3, p = .031). Compared to controls those randomized to the intervention were estimated to use marijuana on 6.15 (95% CI -11.00; -1.09) fewer days at 1-month, 7.81 (95% CI -13.48; -1.98) fewer days at 2 months, and 6.83 (95% CI -12.94; -0.81) fewer days at 3-months. To assess potential sensitivity to subject attrition we replicated the analysis imputing observations lost to follow-up by carrying forward the last observed value. Bias-corrected 95% confidence intervals estimated by bootstrap for the effects of intervention excluded 0 at 1- (b = -4.68, 95% CI -8.83; -0.86), 2- (b = -5.85, 95% CI -10.65; -1.50), and 3-months (b = -5.10, 95% CI -9.95; -0.65), and are considered statistically significant (p < .05). The product moment correlation coefficient between days of marijuana use and days of meditation was -.21 (p=.287).

Few participants achieved full marijuana abstinence and there were no between-group differences in marijuana abstinence at any follow-up time point. Between baseline and 1 month, 3 (11.1%) participants were abstinent, 4 (15.4%) in the period between 1-month and 2-months, and 2 (8.0%) in the period between 2-month and 3 months. Only one participant was abstinent for the entire follow-up period and 1 other participant was abstinent at both 2- and 3-months.

3.4. Meditation Effects on Daily Marijuana Use

Among women randomized to the intervention, 82.3% reported meditating between baseline and 1-month, 75% between 1-and 2-months, and 75.0% in the 30 days prior to the 3-month assessment. Post-treatment meditation was reported by 8.3% of control group participants and 75% of participants in the intervention arm. Among those randomized to the intervention, the mean number of meditation days was 8.47 days per month (SD = 7.25, median = 7, range 0 – 21) at 1-month, 6.25 (SD = 7.91, median = 3.5, range 0 – 26) at 2-months, and 7.04 (SD = 10.27, median = 3, range 0 – 30) at 3-months.

Fixed-effects logistic regression was used to estimate the association between daily meditation and daily marijuana use during follow-up. Here too we estimated bias-corrected 95% confidence interval by bootstrap re-sampling. This analysis was restricted to persons randomized to the MI-MM intervention who were observed for a total of 1,362 person days during follow-up. These participants were only about half as likely (OR = 0.51, 95% CI 0.22; 0.86, p < .05) to use marijuana on days when they meditated than on days when they did not meditate.

4. DISCUSSION

Based on our earlier findings that this population has high rates of anxiety-related symptoms and associates marijuana use with the expectancy of relieving tension and inducing relaxation (de Dios et al., 2010a), we added mindfulness meditation to a motivational intervention. This combined therapy was designed to provide women with alternatives beyond marijuana use for coping with anxiety/tension. Considering our small sample size, our findings provide preliminary evidence for the robust effect of this combined approach in

decreasing days of marijuana use among young adult females. Women randomized to the MI-MM intervention decreased their marijuana use by six to eight days per month beyond the control group and this decrement was sustained through three monthly follow-up assessments.

Despite the fact that only two women in our study achieved full marijuana abstinence at the 3-month follow-up, we consider the decrease in the number of days of use to be a clinically significant treatment effect. Due to the relatively short follow-up, we were not able to test the intervention's impact on marijuana-related problems, however findings from our previous work (de Dios, et al., 2010b) suggest that sustained decreases of 6–7 days of use per month have the potential to impact a number of variables associated with well-being of young adult female marijuana users including interpersonal and social domains, functional abilities, and other substance use.

Among the women in our intervention group, we also found that on the days that they meditated, they were half as likely to use marijuana. This finding provides preliminary evidence for an important aim of our intervention - providing women with an alternative to marijuana use. We speculate that mindfulness-based meditation was an acceptable alternative for participants and possibly offered a method for coping with tension/anxiety which is often achieved through marijuana use. There is a growing body of evidence that substantiates the use of mindfulness-based interventions for a variety of problems, including substance use. However, only one other pilot study (Bowen et al., 2009) has shown a brief mindfulness-based intervention to have an impact on substance use behaviors.

Our study design had important limitations. First, we did not include an attention-matched comparison condition (e.g., MI alone) to determine if MI-MM outperforms another active treatment. Therefore, we cannot fully determine the active ingredients of the current intervention. Our fixed-effects logistic regression modeling partially addressed this limitation by examining the association between daily meditation and marijuana use. However, the lack of an attention-matched comparison condition did not allow for analyses assessing potential dose effects of MI-MM or to active ingredients beyond the participant-level use of meditation. Second, substance use outcomes were based on self-report as few cases achieved full marijuana abstinence (which were confirmed by urine analysis). Nonetheless, studies have found a high concordance rate between self-report and biomarkers of marijuana use (Neale J, & Robertson, 2003; Rose, et al., 2007; Solbergdottir, Bjornson, Gudmundsson, Tyrtingsson, & Kristinsson, 2004). Similarly, we relied on self-report data from the TLFBI interview to assess engagement with the mindfulness meditation component of the intervention. Hence, we are unable to provide more fine-grained details about the duration of practice, use of the CD, or general orientation toward practice (e.g., sense of importance, significance, reasons for using, relationship to marijuana use). Daily assessment might improve upon such retrospective reports. Third, we restricted enrollment to women between the ages of 18 and 29. Thus, our findings may not generalize to older or younger females, or to males.

Our small sample also limited our ability to investigate underlying mechanisms of change. While we demonstrated the feasibility and acceptability of this intervention as well as its effect size, a larger and longer study is needed to allow us to explore changes in mindfulness-related constructs, anxiety, marijuana related problems and psychosocial functioning in this population. Given the prominent role of anxiety-related symptoms in our sample and the expected effect of our mindfulness intervention on anxiety-related symptoms, the lack of analyses specifically testing how our intervention impacting anxiety symptoms at follow-up is a limitation of our study which we will seek to address in a future and larger trial.

Finally, as with most substance abuse clinical trials, maintaining low levels of treatment and follow-up attrition is a challenge. Among women in our intervention group (MI-MM) 27% did not return for the second treatment session. Furthermore, approximately 21% of the entire sample failed to attend any follow-up assessment visit. Based on our previous work with young adult female marijuana users, we expected attrition to be a challenge. Young adult substance abusers are known to be a difficult subpopulation to engage in treatment and research. Therefore, we recommend that future studies involving young adult female marijuana users, attempt to implement retention strategies (e.g., greater compensation) that were not feasible in the current pilot trial.

Despite these limitations, the current study provides preliminary evidence for the feasibility and efficacy of a brief, combined intervention of MI and mindfulness meditation for young adult female marijuana smokers. Considering the prevalence of anxiety symptoms among marijuana users (Andrews, Hall, Teesson & Henderson 1999; Burns & Teesson, 2002; Grant et al., 2004; Teesson, Hall, Lynskey & Degenhard, 2000) and the extent to which marijuana is used as a way to cope with anxiety-related symptoms (de Dios et al., 2010a), the current study is the first step in developing and testing an intervention that can potentially benefit this highly prevalent subpopulation of female young adult marijuana users.

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Table 1

Background Characteristics by Intervention Group (n = 34).

	Mean (SD)			t (p =)
	Total (n = 34)	Control (n = 12)	Intervention (n = 22)	
Years Age	23.03 (2.91)	23.50 (3.34)	22.70 (2.65)	0.69 (.494)
Days Used MJ (0 – 30 Days)	17.68 (9.26)	18.83 (8.09)	17.05 (9.96)	0.53 (.598)
PDSQ GAD	5.59 (2.98)	4.92 (3.12)	5.95 (2.90)	-0.97 (.339)
	n (%)			χ^2 (p =)
Caucasian (Yes)	17 (50.0%)	7 (58.3%)	10 (45.5%)	0.52 (.473)
Employed Part or Full-Time	18 (52.9%)	6 (50.0%)	12 (54.6%)	0.06 (.800)
Lost 1-Month (Yes)	7 (20.7%)	2 (16.7%)	5 (22.7%)	0.17 (.676)
Lost 2-Month (Yes)	8 (23.5%)	2 (16.7%)	6 (27.3%)	0.49 (.486)
Lost 3-Month (Yes)	9 (26.5%)	3 (25.0%)	6 (27.35)	0.02 (.886)
1+ Valid Follow-Ups	27 (79.3%)	10 (83.3%)	17 (77.3%)	0.17 (.676)

Table 2

Fixed-Effects Regression Modeling Estimating the Effect of Intervention on Days Using Marijuana at 1-, 2-, and 3-month Assessments (Valid N= 27)

	b (95% CI)^a
<i>Time</i>	
Month 1	1.20 (-4.17; 2.00)
Month 2	0.20 (-2.67; 3.71)
Month 3	0.79 (-3.24; 5.15)
<i>Treatment by Time</i>	
Treatment by Month 1	-6.15* (-11.00; -1.10)
Treatment by Month 2	-7.81* (-13.33; -2.30)
Treatment by Month 3	-6.83* (-12.94; -0.81)
<u>Constant</u>	18.48* (15.21; 21.81)

*
p < .05

^aBias-corrected 95% confidence intervals estimated by bootstrap with 1000 re-samplings. Confidence interval estimates excluding 0 are considered statistically significant at the .05 level. Model based standard errors for both the fixed effects and random effects estimators were consistent with those we report.