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# Sleep Problems and PTSD Symptoms Interact to Predict Marijuana Use Coping Motives: A Preliminary Investigation

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*The present study empirically tested the theory-based hypothesis that greater sleep problems and post-traumatic stress disorder (PTSD) symptom severity would both individually and multiplicatively predict higher levels of coping-motivated marijuana use. Twenty (15 women) adults ($M_{age}$ = 34.00 years, SD = 11.96) who had PTSD and were currently using marijuana participated. Results indicated a positive independent relation with sleep problems and a significant interaction between sleep problems and PTSD symptom severity in relation to coping-motivated marijuana use. Results also indicated nonsignificant omnibus regression models for all other marijuana use motives. The results suggest that there may be*

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*segments of the PTSD population that are more likely to use marijuana to cope by virtue of individual differences in sleep problems.*

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Estimates suggest that 15% to 55% of treatment-seeking patients with substance use disorders meet current diagnostic criteria for post-traumatic stress disorder (PTSD; Dansky et al., 1996; Grice, Brady, Dustan, Malcolm, & Kilpatrick, 1995). There is a growing recognition that PTSD is associated with increased marijuana use and related problems (Bremner, Southwick, Darnell, & Charney, 1996; Lipschitz, Rasmusson, Anyan, Cromwell, & Southwick, 2000). Relatively little empirical work has focused on the motivational bases for marijuana use among individuals with PTSD. Motivational models identifying a number of distinct motives for substance use provide a meaningful framework for forwarding research in this domain (Cooper, 1994; Cox & Klinger, 1988; Read, Wood, Kahler, Maddock, & Palfai, 2003). Advancing our empirical understanding of the motivation for marijuana use among individuals with PTSD has the potential to inform the development and refinement of models seeking to explain this common co-occurrence as well as treatment programs that follow from such work.

To date, only two studies have examined the association between marijuana use motives and post-traumatic stress. First, Bremner et al. (1996) conducted a retrospective cross-sectional investigation among Vietnam War veterans with PTSD ($n = 61$) and found higher levels of PTSD symptoms associated with increased marijuana use. Furthermore, participants reported using marijuana to manage PTSD-related symptoms of hyperarousal (Bremner et al., 1996). Recently, among a nonclinical community sample of traumatic event–exposed marijuana users ($n = 103$), higher levels of (subclinical) post-traumatic stress symptom severity were significantly related to increased marijuana use for coping reasons (Bonn-Miller, Vujanovic, Feldner, Bernstein, & Zvolensky, 2007).

Exploration of how overall PTSD symptom severity may interact with certain aspects of the post-traumatic stress syndrome in terms of the motivational bases for marijuana use is now needed to advance our understanding of marijuana use among people with PTSD. Sleep problems offer one clinically significant and theoretically relevant mechanism that may serve as a contributing factor to coping-oriented marijuana use among individuals with PTSD (Johnson & Breslau, 2001; Nishith, Resick, & Mueser, 2001). Sleep problems, defined here as a composite of difficulties relevant to subjective sleep quality, sleep latency, sleep duration, sleep efficiency, and sleep disturbances, as well as use of sleep medication and related daytime dysfunction (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), are commonly reported

by people with PTSD (Harvey, Jones, & Schmidt, 2003). Studies suggest that marijuana may be used by individuals with sleep problems because of the drug's promotion of sleep initiation (Chait, 1990). Thus, people with PTSD who experience sleep problems may use marijuana as a short-term regulatory strategy to reduce or manage PTSD-related problems, including those related to sleep (Bonn-Miller et al., 2007; Stewart & Conrod, 2003). Indirect evidence consistent with this postulation has been reported in terms of alcohol use, which evidences similar sleep promotion qualities to marijuana (Chait & Perry, 1994). Here, among people with PTSD, sleep problems were positively related to coping-oriented alcohol use (Nishith et al., 2001). Together, it seems important to extend this prior work by examining the associations among PTSD symptom severity, sleep problems, and coping-oriented marijuana use.

The current investigation aims to address two key limitations in the prior literature. First, there is a dearth of research focused on the associations between PTSD symptoms and marijuana use motives (i.e., Bonn-Miller et al., 2007; Bremner et al., 1996). Second, no study has examined factors that affect the association between PTSD and coping-oriented marijuana use, such as sleep problems. As such, the theoretically based hypothesis that greater sleep problems and greater PTSD symptom severity (excluding sleep problems) would be associated with higher levels of coping-motivated marijuana use among a clinical sample of individuals with PTSD was tested. Additionally, it was hypothesized that a multiplicative effect would exist, such that the interaction between sleep problems and PTSD symptom severity would be associated with greater marijuana use coping motives above and beyond the variance attributable to the respective main effects. This hypothesis was based on the idea that the combination of these constructs would represent a more complete picture of marijuana-relevant PTSD symptomatology, with a greater focus on sleep problems, above the expected independent associations (i.e., main effects) observed in prior literature. As an index of explanatory specificity, no such interactive effect was expected for any other marijuana use motives.

## METHOD

### Participants

A community sample of 20 (15 female) adults ($M_{age}$ = 34.00 years, $SD$ = 11.96) currently using marijuana (i.e., past 30 days) and meeting *Diagnostic and Statistical Manual–Fourth Edition Text Revision* (*DSM-IV-TR*; American Psychiatric Association [APA], 2000) criteria for past-month PTSD was examined. Approximately 60% of participants self-identified as White/non-Hispanic, 10% as Hispanic, 5% as African American, and 25% self-identified as "other" or did not specify ethnicity. In addition to marijuana use and PTSD

status, inclusion criteria consisted of being at least 18 years of age. Exclusion criteria included inability to provide written informed consent and current suicidal ideation. Of the current sample, 7 (35%) participants met criteria for marijuana dependence and 3 (15%) met criteria for marijuana abuse.[1] Of the current sample, 20% used marijuana less than once per week, 10% used marijuana once per week, and 70% used marijuana more than once per week, with 45% of individuals in this group reporting marijuana use multiple times per day. The average age of first use was 14.05 years ($SD$ = 3.72 years), while the average age of onset of regular use was 17.45 years ($SD$ = 3.55). On average, participants had been using marijuana for 10.55 years ($SD$ = 8.29) upon entry to the study. Regarding co-occurring substance use, 70% of the sample ($n$ = 14) reported smoking cigarettes, averaging 13.14 ($SD$ = 8.76) cigarettes daily, and 4 individuals reported a history of smokeless tobacco use. Also, 12 (60%) participants reported current alcohol use, with a mean Alcohol Use Disorders Identification Test (AUDIT; Babor, de la Fuente, Saunders, & Grant, 1992) score of 10.85 ($SD$ = 7.56), suggesting at least moderate levels of alcohol problems. Participants endorsed the following index traumatic events: sexual assault (55%), witnessing murder (15%), physical assault (10%), accidents (5%), combat (5%), robbery (5%), and illness (5%), with a mean total PTSD symptom severity of 11.75.

## Measures

Current *DSM-IV-TR*–defined marijuana abuse and dependence (with the inclusion of substance withdrawal criteria as defined by the *DSM-IV* for other drugs and as assessed by the Structured Clinical Interview–Non-Patient Version for *DSM-IV* [SCID-NP; First, Spitzer, Gibbon, & Williams, 1995] for other drug classes)[1] were determined using the SCID-NP. Adequate reliability of the Axis I SCID-NP has been demonstrated in prior work (Spitzer & Williams, 1986). Demographic characteristics also were collected using the SCID-NP.

The Clinician-Administered Post-traumatic Stress Disorder Scale (CAPS; Blake et al., 1995) was employed to measure criterion A of PTSD, defined as exposure to an event that is perceived as threatening and marked by the experience of fear, helplessness, or horror as well as to measure the frequency and intensity of PTSD symptoms and PTSD diagnostic status. Consistent with prior research (Monson et al., 2006), symptom severity was defined as the total number of symptoms rated at least one in frequency (anchor varies across symptoms; e.g., once a week) and two in severity (anchor varies across symptoms; e.g., moderate). Importantly, symptom severity scores were calculated for symptoms that were specifically related to the traumatic event and after exclusion of the PTSD symptom measuring sleep problems. The CAPS is considered a gold standard for indexing PTSD diagnostic status as well as symptom severity and has demonstrated excellent psychometric properties

(Weathers, Keane, & Davidson, 2001). In the present study, each CAPS administration was conducted by trained clinical assessors and reviewed by the primary investigator to ensure agreement on post-traumatic stress symptom ratings and diagnosis.

The Marijuana Smoking History Questionnaire (MSHQ; Bonn-Miller & Zvolensky, 2009) was employed as an index of current marijuana use. The MSHQ is a 21-item questionnaire that assesses current and lifetime marijuana use. The specific item used to measure current use consisted of participants' ratings of frequency of use within the past month on an 8-point Likert-type scale (0 = no use to 8 = more than once a day). Current marijuana use status was then defined as responses of 1 or greater on this item, indicating at least low levels of use within the past 30 days.

The Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) is a 19-item questionnaire that measures sleep quality and disturbance during the last month. Questions are structured in dual formats: respondents (1) rate items on a 4-point Likert-type scale (0 = very good to 3 = very bad) and (2) answer open-ended questions in which responses are coded based upon established categories. For the purposes of the current study, the PSQI global score was employed as a measure of overall sleep problems. The global score of the PSQI had an overall high level of internal consistency (Cronbach's alpha = .83 for the overall reliability coefficient) and has demonstrated good test-retest reliability and discriminant validity (Buysse et al., 1989). A global score of 5 is indicative of clinical levels of sleep problems (Buysse et al., 1989). In addition, past research among individuals with severe symptoms of PTSD and significant sleep problems yielded a mean global PSQI score of 11.66 (Germain, Buysse, Shear, Fayyad, & Austin, 2004).

The Marijuana Motives Measure (MMM; Simons, Correia, Carey, & Borsari, 1998) is a 25-item measure in which respondents indicate on a 5-point Likert-type scale (1 = almost never/never to 5 = almost always/always) the degree to which they have smoked marijuana for a variety of possible reasons (e.g., "to be sociable"). The MMM consists of 5 first-order factors: (1) enhancement (e.g., "to get high"); (2) conformity (e.g., "to fit into the group I like"); (3) expansion (e.g., "to expand my awareness"); (4) coping (e.g., "to forget my worries"; "to cheer me up when I am in a bad mood"); and (5) social (e.g., "makes social gatherings more fun"), each of which has demonstrated high internal consistency (Simons et al., 1998; Zvolensky et al., 2007). Subscale scores are computed by calculating a mean of all items that comprise each scale, yielding a possible range of 1 through 5. Additionally, as the MMM was developed for community samples (Simons et al., 1998), it does not contain any questions that specifically relate to PTSD symptoms, including sleep problems.

The AUDIT (Babor et al., 1992) is a 10-item questionnaire developed by the World Health Organization to index the quantity/frequency of alcohol use and related problems (Saunders, Aasland, Babor, de la Fuente, & Grant,

1993). In the present study, the AUDIT total score was utilized to measure alcohol use levels and current problems related to such use.

## Procedure

Participants were recruited through newspaper advertisements, flyers, and announcements that described a laboratory study on "stressful life events." After completing written informed consent, the SCID-NP and CAPS were administered to all participants. Participants then completed a series of measures, including the MSHQ, PSQI, MMM, and AUDIT. Participants were then debriefed and monetarily compensated.

## Data Analytic Approach

All analyses were conducted with SPSS 16.0. First, correlations among continuous predictor and criterion variables were examined. To test the independent and interactive relations between sleep problems and PTSD symptom severity in relation to marijuana use motives, five separate hierarchical linear regressions were conducted with each MMM subscale included as the criterion variable in separate analyses. All predictor variables were mean-centered prior to analyses (Holmbeck, 2002). Patterns of significant interactions were examined according to published recommendations (Holmbeck, 2002). Squared semi-partial correlations ($sr^2$) were used to index effect sizes (Cohen, 1988).

# RESULTS

Table 1 presents zero-order correlations among continuous variables. Coping motives were significantly positively correlated with sleep problems ($r = .57$, $p < .01$), but not PTSD symptom severity ($r = .23, p > .05$). No other motives were correlated with the predictor variables.

**TABLE 1** Descriptive Data and Zero-Order Relations Among Predictor and Criterion Variables

| | Mean (*SD*) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| 1. Sleep problems | 11.20(3.94) | — | .46* | .08 | .25 | −.11 | .26 | .57** |
| 2. PTSD symptom severity | 11.75(3.59) | — | — | −.13 | .08 | .04 | .28 | .23 |
| 3. MMM-enhancement | 3.50(.97) | — | — | — | .70** | .41 | .26 | .45* |
| 4. MMM-social | 2.70(1.33) | — | — | — | — | .41 | .32 | .53* |
| 5. MMM-conformity | 1.20(.44) | — | — | — | — | — | .31 | −.05 |
| 6. MMM-expansion | 2.27(1.49) | — | — | — | — | — | — | .29 |
| 7. MMM-coping | 3.65(1.11) | — | — | — | — | — | — | — |

*Note.* PTSD = post-traumatic stress disorder; MMM = Marijuana Motives Measures (Simons et al., 1998).
*$p < .05$; **$p < .01$.

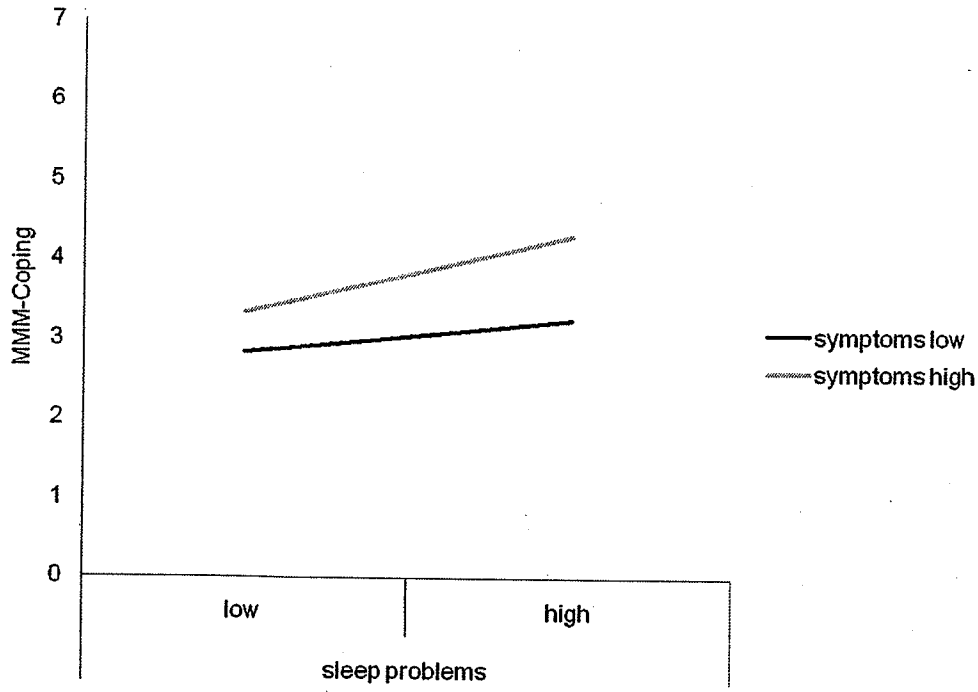


**FIGURE 1** Marijuana use coping motive levels among participants ± .5 *SD* above and below the mean for sleep problems and post-traumatic stress disorder (PTSD) symptom severity. The cell sizes for each group are as follows: (1) low sleep problems—low PTSD symptoms ($n = 3$); (2) high sleep problems—low PTSD symptoms ($n = 5$); (3) low sleep problems—high symptoms ($n = 3$); and (3) high sleep problems—high PTSD symptoms ($n = 9$). Please refer to Table 1 for the means used for the construction of the sleep problems and PTSD score points.

Regression analyses indicated a significant omnibus model relevant to marijuana use coping motives [$F = 5.79$, $R^2 = .52$, $p < .05$], with sleep problems being the only significant predictor at level 1 [$\beta = .59$; $p < .05$]. The interaction term at level 2 accounted for a significant additional 19% of unique variance [$\beta = -.78$; $p < .01$] in coping motives.[2] As recommended by Cohen, Cohen, West, and Aiken (2003), the form of the interaction was first examined by graphing the pattern (see Figure 1). Here, high/low cutoffs were created at ± .5 *SD* above and below the mean for sleep problems and PTSD symptom severity. Next, consistent with standards for testing moderation (Holmbeck, 2002), post hoc probing analyses were conducted. Sleep problems were positively related to marijuana use coping motives among individuals reporting both high PTSD symptom severity [$t = 3.24$, $p < .01$] and low PTSD symptom severity [$t = 3.37$, $p < .01$].

Four separate regression analyses were conducted to examine the interaction between sleep problems and PTSD symptom severity in the prediction of each of the other four motives for marijuana use. Results indicated

nonsignificant omnibus regression models for all four of the other motives, including social motives [$F$ (3, 16) = 1.17, $p > .05$], conformity motives [$F$ (3, 16) = .27, $p > .05$], expansion motives [$F$ (3, 16) = .94, $p > .05$], and enhancement motives [$F$ (3, 16) = .80, $p > .05$]. Due to nonsignificant omnibus models, further investigation into these models was not conducted.

## DISCUSSION

Despite the common co-occurrence of marijuana use and PTSD (Bremner et al., 1996; Lipshitz et al., 2000), little research has examined factors that affect this association. To help fill this gap, the current study sought to examine the main and interactive effects of sleep problems and PTSD symptom severity in relation to coping-motivated marijuana use among a sample of individuals with PTSD.

As predicted, self-reported sleep problems were positively associated with the degree to which individuals were using marijuana to cope. This finding is consistent with research suggesting that sleep problems positively correlate with using alcohol to cope among people with PTSD (Nishith et al., 2001) and work suggesting that marijuana use may facilitate sleep initiation (Chait, 1990). Contrary to expectation, a direct relation between PTSD symptom severity and marijuana use coping motives was not observed. This null result is similar to that documented among alcohol users with diagnosed PTSD (Nishith et al., 2001), although it is inconsistent with findings among subclinical marijuana users (Bonn-Miller et al., 2007). It is possible this disparity in findings is due to differences in variability of symptom severity among individuals with PTSD as compared to subclinical populations (i.e., most individuals with PTSD are experiencing relatively severe symptom levels). Relatedly, it is possible that the current study did not have sufficient power to detect a significant relation ($n = 20$), as the strength of the observed association between PTSD symptom severity and coping motives herein is similar to that found by Bonn-Miller et al. (2007; $r = .23$ as compared to .29). Further replication and extension of this work is necessary in order to more meaningfully explicate this relation.

Consistent with expectations, sleep problems and PTSD symptom severity interacted to uniquely relate to marijuana use coping motives above and beyond the main effects of each. Although an interaction was found, post hoc probing analyses revealed that the relation between sleep problems and marijuana use coping motives existed independent of the level of PTSD symptom severity, consistent with the lack of zero-order relation between PTSD symptom severity and coping motives. These findings highlight sleep problems as the primary driving force of the significant interaction, suggesting that individuals at highest risk for using marijuana for coping reasons are those with high levels of sleep problems. Also, consistent with prediction

and prior work (Bonn-Miller et al., 2007; Nishith et al., 2001), neither PTSD symptom severity nor sleep problems were related to other motives for marijuana use, providing evidence of discriminant validity of models seeking to understand why individuals with PTSD use marijuana. Specifically, these data, albeit preliminary in nature given the small sample size, suggest that using marijuana for coping reasons is more central to this type of co-morbidity than using marijuana for other reasons.

Broadly, these findings have potential clinical implications. While marijuana may be used by individuals with PTSD as a short-term strategy to cope with sleep problems, the discontinuation of heavy marijuana use has been documented to produce an internally consistent withdrawal profile that includes disrupted sleep, strange dreams, nausea, anxiety, tension, irritability, sweating, and chills (Budney, Moore, Vandrey, & Hughes, 2003). Thus, discontinuation of heavy marijuana use might be especially problematic for individuals with PTSD, as marijuana withdrawal might exacerbate existing PTSD symptoms (e.g., nightmares, hyperarousal) as well as increase general negative affectivity. Given use motivated by coping, risk for relapse during a quit attempt is likely high. Taken together, the current findings suggest possible utility in directly addressing sleep problems among individuals with PTSD in order to reduce the need for coping-oriented marijuana use and increase the likelihood of success during a marijuana quit attempt. More work in this domain is warranted to provide a more comprehensive understanding of the cognitive-affective and behavioral mechanisms underlying associations between PTSD and coping-oriented marijuana use to improve specialized treatment interventions.

There are a number of study limitations that warrant mention. First, the present study employed a cross-sectional design, not permitting an examination of the temporal relation among PTSD symptom severity, sleep problems, and coping-oriented marijuana use. Future studies could utilize a prospective design to determine whether increases in sleep problems or PTSD symptom severity indeed lead to marijuana use for coping reasons. Second, the current sample was small ($n = 20$) and comprised mostly female White/Caucasian participants. Although the significant interactive effects are notable and clinically meaningful, it is important for this work to be replicated and extended using larger and more diverse samples before more definitive conclusions are drawn. Third, the current study utilized self-report measures as the primary assessment strategy. Future work might utilize multi-method assessment strategies, employing "real-time" tracking of marijuana use and PTSD symptomatology, as well as direct observation of sleep patterns, to more accurately measure not only frequency and quantity of marijuana use but also the timing and effects of such use on PTSD symptoms and negative affective states.

In conclusion, the present investigation represents an important initial step in terms of better understanding a PTSD model of marijuana use from a

motivational perspective. The results suggest that there may be segments of the PTSD population that are more likely to use marijuana to cope by virtue of individual differences in sleep problems.

## NOTES

1. Marijuana abuse and dependence (with the inclusion of substance withdrawal criteria as defined by the *DSM-IV* for other drugs and as assessed by the SCID-NP for other drug classes) criteria were derived from the *DSM-IV-TR* (APA, 2000). Although the inclusion of withdrawal is not currently consistent with *DSM-IV-TR* criteria for marijuana dependence, it was included as it is consistent with the definition of marijuana dependence provided by Budney, Hughes, Moore, and Vandrey (2004) and is likely to be included as a core defining feature of dependence in future *DSM* iterations.

2. Analyses also were conducted with the inclusion of marijuana use frequency as a covariate. Frequency of marijuana use did not significantly contribute to the model, and the interaction between PTSD symptoms and sleep problems remained statistically significant.

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