# THE ROLE OF DEPRESSIVE AND PANIC SYMPTOMS IN PREDICTING CANNABIS USE COGNITIVE PROCESSES AND QUIT BEHAVIOR

_____

A Thesis

Presented to

The Faculty of the Department

of Psychology

University of Houston

_____

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

_____

By

Samantha G. Farris

December, 2012

THE ROLE OF DEPRESSIVE AND PANIC SYMPTOMS IN PREDICTING CANNABIS USE COGNITIVE PROCESSES AND QUIT BEHAVIOR

_____

An Abstract of a Thesis

Presented to

The Faculty of the Department

of Psychology

University of Houston

_____

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

_____

By

Samantha G. Farris

December, 2012

## ABSTRACT

Despite the high rates of anxiety/mood disorders among cannabis dependent individuals, there is little research on the role of panic and depressive symptoms among Veterans – a population with high rates of substance use-anxiety and mood comorbidity. The current study examined the main and interactive effects of panic and depressive symptoms on maladaptive expectations and motives for cannabis use, cannabis-related problems, and quit behavior among cannabis-dependent Veterans. **Method:** Participants (n = 100) were cannabis dependent Veterans participating in a cannabis self-guided quit study. Panic/depressive symptoms were assessed prior to the quit-attempt using two subscales of the Inventory of Depression and Anxiety Symptoms (IDAS); expectancies were assessed using the Marijuana Effect Expectancies Questionnaire–Tension Reduction/Relaxation subscale (MEEQ); motives were assessed using the Marijuana Motives Questionnaire–Coping subscale (MMQ). Pre-quit cannabis-use problems were assessed with the Marijuana Problems Scale (MPS); Substance use prior and following the quit-attempt was assessed with the Timeline Follow-Back (TLFB). A series of hierarchical regression-based models were conducted: Pre-quit cannabis and other substance use were entered as covariates, followed by the main effects of IDAS subscales, then the interaction. **Results:** The interaction term significantly predicted MEEQ-Tension Reduction/Relaxation, with highest scores reported among those with high IDAS-Depression and Panic scores. The interaction term also was significantly predictive of MMQ-Coping, and was highest among those with high IDAS-Depression and low IDAS-Panic scores. IDAS-Depression was uniquely predictive of greater cannabis problems on the MPS. Regarding quit behavior, IDAS-Panic was marginally predictive of time to

relapse in the first 28 days post-quit attempt, with higher scores predicting an increased risk for relapse. Additionally, IDAS-Panic significantly interacted with time to predict fewer percent days abstinent and more cannabis use per use occasion during follow-up. **Conclusion:** Findings are discussed in relation to the existing literature on anxiety/depressive symptoms in relation to cannabis use processes and quit behavior.

## ACKNOWLEDGMENTS

These data were collected as part of a grant funded by the Veterans Administration Clinical Science Research and Development (CSR&D) Career Development Award-2, awarded to Dr. Marcel O. Bonn-Miller. Dr. Mathew Boden graciously provided guidance with data analytic strategy and methodology, and Meggan Bucossi skillfully assisted with management of the database for this study.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

# THE ROLE OF DEPRESSIVE AND PANIC SYMPTOMS IN PREDICTING CANNABIS USE COGNITIVE PROCESSES AND QUIT BEHAVIOR

## Cannabis Use, Properties, and Effects

Cannabis use is a major public health problem, impacting an estimated 125 to 205 million adults globally and approximately 32.5 million in North America (Degenhardt & Hall, 2012; Substance Abuse and Mental Health Services Administration [SAMHSA], 2011). Cannabis use most commonly begins during late teens to early 20's (Copeland & Swift, 2009), though the rates and frequencies of use can vary dramatically (Stephens, 1999). In the past year, approximately 17.4 million individuals, ages 12 or older in the United States, reported any cannabis use and 6.9 million endorsed cannabis use on more than twenty days in the past month (SAMHSA, 2011).

Cannabis is typically derived from the dried flower, stalk, leaves, and seeds of the cannabis sativa plant and can be consumed through inhalation (e.g., smoked) or ingestion (Ashton, 2001; Stephens, 1999). Cannabis contains over sixty psychoactive chemical compounds called cannabinoids and while the chemical composition of most cannabinoids is unknown, the most studied is detla-9-tetrahydrocannabinnol (THC) and cannabinol (CBC; a metabolite of THC) – these are believed to be the primary psychoactive and addictive agents in cannabis (Ashton, 2001; Stephens, 1999). The onset of the effects of intoxication can vary depending on method of consumption, ranging from ten minutes (when smoked) to hours (when ingested), though there are large inter-individual differences in rates of consumption (Stephens, 1999). When absorbed by the body, THC and other cannabinoids bind to cannabinoid receptors located in various areas

of the brain that influence thinking (cerebral cortex), memory (hippocampus), and motor coordination (cerebellum; Herkenham, 1995; Stephens, 1999) and are associated with modulation of dopaminergic pathways, which can influence the production of acute states of euphoria (Tanda, Pontieri, & Di Chiara, 1997).

Acute effects of cannabis intoxication include a range of cognitive, emotional, physiological, and behavioral effects including euphoria, vivid perception, sedation, lethargy, slowing of cognitive and psychomotor performance, and anxiolytic effects (e.g., decrease in anxiety, depression, tension; American Psychiatric Association [APA], 2004; Ashton, 2001; Crippa et al., 2012; Stephens, 1999). Acute and possibly persisting effects of cannabis can include impaired memory, attention, and decision-making (Lynskey & Hall, 2000; Solowij & Pesa, 2010) as well as respiratory (e.g., chronic bronchitis and emphysema) and cardiovascular (e.g., tachycardia) effects (see reviews by Ashton, 2001 and Crippa et al., 2012). Overall, a reliable dose-response effect has been documented whereby, as the quantity and frequency of use increase, psychological and physical effects intensify (Ashton, 2001; Crippa et al., 2012; Johns, 2001; Solowij & Pesa, 2010; Tanda & Goldberg, 2003). Of course, the quality and type of THC may affect the pattern of consumption (e.g., higher THC content may lead to lower patterns of use for certain individuals; Ashton, 2001; Stephens, 1999).

Cannabis Use Disorders

Notably, experimental or infrequent cannabis use can be distinguished from problematic or hazardous use. Indeed, the large majority of individuals that use cannabis do not develop a cannabis use disorder (Copeland & Swift, 2009). It is estimated that roughly 4.5 million adults in the U.S. (SAMSHA, 2011) have a current cannabis use

disorder (abuse or dependence), as defined by the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition – Text Revision (DSM-IV-TR; APA, 2000). *Cannabis abuse* is characterized by a "maladaptive pattern of substance use manifested by recurrent and significant adverse consequences related to the repeated use of cannabis" (DSM-IV-TR, pg. 198-199; APA, 2000), prodromal to cannabis dependence. *Cannabis dependence* is defined by a constellation of cognitive, behavioral, and physiological symptoms that indicate continued substance use despite significant substance-related problems (DSM-IV-TR, pg. 191-197; APA, 2000), and theoretically, represent more severe symptoms. The full DSM-IV-TR diagnostic criteria are listed in Table 1.

Several epidemiological studies have estimated the base rate of current (past year) cannabis use disorders of 1.1% for abuse and 0.4% for dependence, with lifetime rates of either disorder of 4.0%-9.0% (Agosti, Nunes, Levin, 2002; Anthony, Warner, Kessler, 1994; Compton, Grant, Colliver, Glantz, & Stinson, 2004; Lopez-Quintero et al., 2011; Kandel, Chen, Warner, Kessler, & Grant, 1997; Stinson, Ruan, Pickering, & Grant, 2006). In fact, one of the primary consequences of cannabis use is the potential onset of dependence (Degenhardt & Hall, 2012). Specifically, among current cannabis users, presence of a cannabis abuse or dependence disorder is estimated at 35.6% (Compton et al., 2004) and the overall lifetime risk of transitioning to cannabis dependence is about 1 in 10 (Anthony et al., 1994; Lopez-Quintero et al., 2011). Moreover, the *rate of transition* from cannabis use to dependence is rapid (5 years) in comparison to many substances dependence disorders like alcohol (27 years; Lopez-Quintero et al., 2011).

In comparison to cannabis users, cannabis use disordered individuals report significantly lower perceived mental health functioning (Lev-Ran et al., 2012). Some

work also suggests cannabis use disordered individuals are at a significant increased risk for suicidal ideation and actual attempts in comparison to non-disordered individuals (Beautrais, Joyce, & Mulder, 1999; Lynskey et al., 2004), and may be more likely to engage in cannabis use for maladaptive reasons (Zvolensky et al., 2007). Moreover, functional impairment among cannabis use disordered persons is common, especially in domains related to primary support, occupation, and finances (Compton, Simmons, Weiss, & West, 2011). This increased 'risk-profile' among cannabis use disordered individuals may be partially explained by presence of psychiatric symptoms and disorders (Beautrias et al., 1999; Buckner & Carroll, 2009; Buckner, Joiner, Schmidt, & Zvolensky, 2012; Compton et al., 2011; Johns, 2001; Secora et al., 2010; Van Dam, Bedi, & Earleywine, 2012), which occur at rates that exceed those of non-cannabis dependent individuals and non-cannabis users (Lev-Ran et al., 2012; Stinson et al., 2006). For example, among cannabis use disordered individuals from a representative civilian population, rates of current co-occurring alcohol use disorders and nicotine dependence were 57.6% and 53.1%, and rates of mood and anxiety disorders were 29.9% and 24.1% (Stinson et al., 2006). These rates are even higher when examining cannabis dependence only (i.e., not including abuse; Stinson et al., 2006). In contrast, past year base rates of these disorders are much lower among the general population: alcohol use disorders (4.4%), nicotine dependence (5.5%), mood disorders (9.5%), and anxiety disorders (18.1%; Babson, Feldner, Sachs-Ericsson, Schmidt, & Zvolensky, 2008; Kessler, Chiu, Demler, & Walters, 2005).

Notably, for well over a decade, the cannabis dependence diagnosis has been debated due to the lack of consistent evidence for the withdrawal syndrome (Copeland &

Swift, 2009; Stephens, 1999). Recent studies, however, have provided empirical evidence of withdrawal symptoms after cannabis use (Budney & Hughes, 2006; Budney, Hughes, Moore, Vandrey, 2004; Cornelius, Chung, Martin, Wood, & Clark, 2008; Chung, Martin, Cornelius, Clark, 2008; Gorelick et al., 2012). In light of these results, a revision to the cannabis use disorder symptom profile has been proposed for the DSM-5 (APA, 2012), such that withdrawal syndrome will now be included as a cannabis dependence criterion. Recent research investigations have begun to utilize these revised cannabis dependence criteria (e.g., Bonn-Miller & Zvolensky, 2009).

Emotional Distress and Cannabis Dependence

Some of the most promising work in the realm of psychiatric comorbidity and cannabis dependence has been completed in the area of mood and anxiety symptoms and disorders. This approach is well-aligned with the recent recommendations from researchers that have suggested that a transdiagnostic approach may be more informative and generalizable than disorder-specific research (McManus, Safran, & Cooper, 2010). For clarity and ease of presentation, from this point forward, and consistent with the language employed in transdiagnostic approaches (Watson, 2000), mood and anxiety symptom and disorders will be generally referred to as "emotional distress." There are at least three streams of empirical evidence that document the co-occurrence of emotional distress and cannabis dependence.

First, emotional distress is common among cannabis dependent individuals. For example, past-year mood and anxiety disorders are reported at rates of 48.2% and 43.5%, respectively (Agosti et al., 2002; Brook, Cohen & Brook, 1998; Buckner, Zvolensky, & Schmidt, 2012; Chen, Wagner, & Anthony, 2002; Cougle, Bonn-Miller, Vujanovic,

Zvolensky, & Kawkins, 2011; Grant, 1995; Stinson et al., 2006; Tournier, Sorbara, Gindre, Swendsen, & Verdoux, 2003). These rates are striking given the comparably significant lower base rates of past-year mood (9.5%) and anxiety disorders (18.1%) among the general population (Kessler et al., 2005).

Second, studies have documented that cannabis dependence, but not use or abuse, is generally, but not uniformly, related to an increased risk of mood/anxiety psychopathology. For instance, cannabis dependence has been found to be related to an increased risk of major depressive episodes and disorder (Agosti et al., 2002; Chen et al., 2002; Grant, 1995; Kessler et al., 1997). Additionally, cannabis dependence is significantly predictive of the later development of depressive symptoms (e.g., anhedonia, suicidal ideation; Bovasso, 2001). There is less prospective study of cannabis dependence and anxiety psychopathology. In one of the few studies in this area, results indicated that cannabis dependence was associated with an increased risk in panic attacks and disorder (Zvolensky, Lewinsohn, et al., 2008); however, this association was no longer significant after controlling for daily cigarette use. This work suggests cannabis dependence may 'mark risk' for panic psychopathology, but not necessarily serve as a causal risk factor for it.

Third, the acute effects of cannabis use have further stimulated emotional distress–cannabis interconnections among cannabis dependent persons. The acute effects of cannabis use often include feelings of detachment, depersonalization, and panic attacks (Johns, 2001; Metrik, Kahler, McGeary, Monti, & Rohsenow, 2011). As one illustrative example, nearly 40% of frequent cannabis users report the presence of panic attacks after use (Hathaway, 2003; Thomas, 1996). Based on the increased physiological responses to

acute cannabis use (e.g., increased heart rate within 10-14 minutes of use; Hart, van Gorp, Haney, Foltin, & Fischman, 2001; Metrik et al., 2011), it is possible that certain cannabis using individuals may interpret somatic changes in different ways. Such interpretations may influence acute emotional reactions to cannabis use (e.g., euphoria versus anxiety/ depersonalization; Metrik et al., 2011).

Theoretical Model for Conceptualizing Cannabis-Emotional Distress Processes

Given the established co-occurrence between emotional distress and cannabis use and disorders, research efforts have attempted to explicate the nature of this association. One conceptual model (Zvolensky, Bernstein, Marshall, & Feldner, 2006) predicts that the associations that exist between substance use behavior and emotional distress are "reciprocal and dynamic," proposing a complicated relation between moderating (i.e., influence the association between substance use behavior and emotional distress) and mediating variables (i.e., account for the relations between substance use behavior and emotional distress). For example, a specific type of drug (e.g., cannabis) and use pattern (e.g., dependence) is linked to a particular type of problem (e.g., panic symptoms) via a specified mediating process (e.g., maladaptive cognitive processes) in the context of certain moderating variables (e.g., high trait anxiety). Indeed, this model is general and it is presumed that there is specificity between differential substance use behaviors, moderators, mediators, and various forms of emotional distress.

Cannabis Effect Expectancies. One line of research has utilized expectancy theory models to better explicate the nature of substance use behavior. As one of the most widely endorsed mechanistic cognitive constructs in drug use (Brown, Goldman, Inn, & Anderson, 1980; Schafer & Brown, 1991), expectancy outcomes are defined as one's

belief about the anticipated effect of use, which, in turn affects when and how much an individual engages in substance use (Aarons, Brown, Stice, & Coe, 2001; Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Brandon & Baker, 1991; Hayaki et al., 2010; Jones, Corbin, & Fromme, 2001; Tiffany, 1990). Indeed, reinforcement-based expectancies are robustly related to the initial experimentation and onset of risk taking and substance use in adolescents (Fromme, Katz, & D'Amico, 1997) as well as the maintenance of substance use behavior and problems (Baker, Piper et al., 2004; Brown, 1985; Brown et al., 1980; Christiansen, Smith, Roehling, & Goldman, 1989; Copeland, Brandon, & Quinn, 1995; Jones et al., 2001; Kristjansson, Agrawal, Lynskey, & Chassin, 2012; Wetter et al., 1994). Effect expectancies may vary as a function of the type of substances use (e.g., Aarons et al., 2001; Martens & Gilbert, 2008). Moreover, differences in substance use expectancies across individuals are thought to explain variance in actual substance consumption (Jones et al., 2001).

To date, several measures of cannabis expectancies have been developed. One of the first was the Marijuana Effect Expectancies Questionnaire (Schafer & Brown, 1991), a 70-item assessment of different beliefs about the effects cannabis use may have, and yield two higher-order factors: positive and negative expectancies. Research has found that negative expectancies (e.g., *"Marijuana can make my feelings from happy to sad")* are associated with lower rates of use, non-use, or those who have quit cannabis use *(*Aarons et al., 2001; Shafer & Brown, 1991; Galen & Henderson, 1999), and positive expectancies are associated with higher quantities and frequency of use (Aarons et al., 2001; Galen & Henderson, 1999; Shafer & Brown, 1991; Simons & Arens, 2007); positive expectancies include: Social/Sexual Facilitation (e.g., *"I am more sociable when*

*I smoke marijuana"),* Perceptual/Cognitive Enhancement (e.g., *"I become more creating or imaginative on marijuana"*), and Relaxation/Tension Reduction (e.g., *"I get a sense of relaxation from smoking marijuana"*).

Consistent with negative-affect reduction models of drug-use (Baker et al., 2004), Relaxation/Tension Reduction expectancies may be most germane to explicating the emotional distress-cannabis link. On study compared undergraduate cannabis users and non-users and found that positive expectancies were positively associated with greater frequency of cannabis use, whereas negative expectancies were negatively associated with cannabis use frequency (Simons & Arens, 2007). Among a sample of male Veterans receiving treatment for chemical dependency, current cannabis users uniquely reported greater Tension Reduction/Relaxation expectancies than non-users, whereas non-users reported greater negative effect expectancies than current users (Galen & Henderson, 1999). In the context of high emotional distress, it is possible that cannabis users with higher levels of emotional distress symptoms have greater expectations that cannabis will regulate their affect – and in the absence of adaptive coping resources, may be more apt to initiate and continue use. Yet, research on emotional distress and cannabis expectancy is presently highly limited.

Cannabis Use Motives. A related, yet distinct line of research has increasingly found merit in applying motivational models to this substance use behavior. This work has built from the study of alcohol (Cooper, Frone, Russell, & Mudar, 1995; Cox & Klinger, 1988; Stewart, Zeitlin, & Samoluk, 1996; Stewart, Zvolensky, & Eifert, 2001) and tobacco use (Baker, Brandon, & Chassin, 2004; Ikard, Green, & Horn, 1969; Piper et al., 2004; Russell, Peto, & Patel, 1974; Zvolensky, Feldner et al., 2004). Such an

approach recognizes that motives can vary both between and within individuals, and that distinct motives may theoretically be related to particular types of problems (Cooper, 1994). For example, specific motives may play unique roles in various aspects of use (e.g., addictive use, withdrawal symptoms, craving) or problems related to use (e.g., psychological disturbances, risk taking behavior). Thus, empirically examining cannabis use motives will presumably facilitate understanding of the nature of cannabis use and its disorders as well as linkages between cannabis use and its clinically important correlates, as it has for alcohol and tobacco use (Cooper, 1994; Piper et al., 2004).

The most popular index of cannabis motives for use is the Marijuana Motives Questionnaire (MMQ; Simons, Correia, Carey, & Borsari, 1998), a 25-item measure that has thus far indicated that there are distinct, replicable, and internally consistent factors of cannabis use motives (Simons, Correia, & Carey, 2000): Enhancement (e.g., *"because it's exciting"*), Conformity (e.g., *"to fit in with the group I like"*), Expansion (e.g., *"to expand my awareness"*), Coping (e.g., *"to forget my worries"*), and Social motives (e.g., *"because it makes social gatherings more fun"*; Chabrol, Duconge, Casas, Roura, & Carey, 2005; Simons et al., 1998; Zvolensky et al.,, 2007). Specific cannabis use motives have shown explanatory relevance in a variety of ways. For example, Coping motives for cannabis use mediate the relation between social anxiety and cannabis use problems (Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007) as well as the relation between negative affect regulation and cannabis use problems (Simons, Gaher, Correia, Hansen, & Christopher, 2005). Other work indicates that Enhancement, Expansion, Coping, and Social motives have been related to greater frequency of cannabis use (Bonn-Miller,

Zvolensky, & Bernstein, 2007; Bonn-Miller, Vujanovic, Feldner, Bernstein, & Zvolensky, 2007; Buckner et al., 2007; Simons et al., 1998).

One line of inquiry in regard to the study of cannabis use motives has focused on relations between emotional vulnerability factors and coping-oriented cannabis use (e.g., Bonn-Miller, Vujanovic, & Zvolensky, 2008; Comeau, Stewart, & Loba, 2001). For example, anxiety sensitivity is one possible contributing factor for these observed linkages between anxiety and cannabis use problems. Anxiety sensitivity reflects individual differences in the fear of anxiety and arousal-related sensations (McNally, 2002; Taylor, 1999). When anxious, individuals high in anxiety sensitivity become acutely fearful due to beliefs that these interoceptive sensations have harmful physical, psychological, or social consequences (Taylor et al., 2007). Over time, elevated levels of anxiety sensitivity predict greater risk for anxiety, and to a lesser extent depressive, symptoms and disorders (Feldner, Zvolensky, Schmidt, & Rose, 2008; Hayward, Killen, Kraemer, & Taylor, 2000; Li & Zinbarg, 2007; Maller & Reiss, 1992; Schmidt, Lerew, & Jackson, 1997, 1999; Schmidt, Zvolensky, & Maner, 2006). Anxiety sensitivity has been shown to be significantly related to coping-oriented cannabis use motives among adolescents (Comeau et al., 2001) and adults (Bonn-Miller, Zvolensky et al., 2007; Mitchell, Zvolensky, Marshall, Bonn-Miller, & Vujanovic, 2007). To the extent anxiety sensitivity is associated with increased risk for emotional distress, persons with high compared to low levels of this factor may desire to use cannabis to cope with such distressing symptoms. In fact, Buckner and colleagues (2011) found using time sampling methodology that individuals with greater levels of anxiety sensitivity were significantly more apt to use cannabis over time. In this sense, this emotional sensitivity factor

(anxiety sensitivity) may be important for understanding linkages between cannabis use problems and emotional distress. Yet, little work has addressed the more 'basic role' of emotional distress in cannabis use motives such as anxiety and depressive symptoms.

Cannabis Cessation Processes. There also is emerging work on factors that predict failure to maintain abstinence in attempts to quit using cannabis. For example, studies examining short-term outcomes have found that early lapses are predictive of later relapses among adult and adolescent cannabis abuse or dependent individuals, regardless of whether they receive formal treatment or not (Agosti & Levin, 2007; Harrison & Asche, 2001; Latimer, Winters, Stinchfield, & Traver, 2000; Moore & Budney, 2003). Also, co-occurring substance use is related to cannabis use relapse among adolescent cannabis use disordered outpatients (Latimer et al., 2000).

Consistent with emotion-substance use theoretical models (Zvolensky et al., 2006), emotional distress may negatively impact cannabis use outcomes in the context of dysregulated emotional states before or during the quit attempt and without adaptive affect-modulating strategies. For example, one study found that individuals previously receiving psychiatric treatment (e.g., for anxiety) were more likely to seek treatment for cannabis dependence in the future (Arendt, Rosenberg, Foldager, Perto, & Munk-Jørgensen, 2007). Likewise, cannabis withdrawal symptoms, which tend to be primarily emotional or behavioral in nature (e.g., irritability, nervousness, restlessness), are predictive of re-initiation of cannabis use (e.g., rapid relapse; Cornelius et al., 2008). This finding is notable because emotional distress is a commonly experienced withdrawal symptom among cannabis dependent individuals (Budney et al., 2004; Cornelius et al., 2008). With the exception of these few investigations, there is limited understanding how

emotional distress may affect early quit processes (lapse and relapse) or prolonged success over time. In one important and directly relevant study, greater anxiety symptoms among cannabis dependent patients were significantly related to greater cannabis-related problems at four and nine-months post-cannabis treatment (Buckner & Carroll, 2010). Moreover, reductions in anxiety between baseline and 4 months were associated with reductions in frequency of cannabis use (Buckner & Carroll, 2010). To the best of our knowledge, we are not aware of any studies that examine depressive symptomology as a predictor of cannabis quit behavior.

Summary. There is consistent existing theoretical and empirical support that documents the inter-relations between emotional distress and substance use disorders. As is now discussed, there may be utility in exploring the role of emotional distress, such as panic and depressive symptoms, in among cannabis using military Veterans.

United States Veterans: Cannabis Dependence and Emotional Distress

Recent substance use research efforts have attempted to identify particularly vulnerable sub-sets of the population for early intervention or targeted treatment (see review by Flynnn & Brown, 2006; Watkins, Hunter, Burman, Pincus, & Nicholson, 2005; Ziedonis et al., 2008). Veteran populations have been the focus of attention for psychiatric and behavioral research given the documented elevated rates of substance use disorders, psychiatric disorders, and suicide among this group compared to general civilian populations (Goldman et al., 2010; Hoge, Auchterlonie, & Milliken, 2006; Hoge et al., 2004; Ilgen et al., 2010, 2012; Kang & Bullman, 2008; Milliken, Auchterlonie, & Hoge, 2007; Seal et al., 2011; Simpson et al., 2012). Among Veterans, substance use disorders are associated with increased functional impairment, medical problems,

homelessness, and suicide (Edens, Kasprow, Tsai, & Rosenheck, 2011; Nazarian, Kimerling, & Frayne, 2012); these data highlight the public health relevance of addressing substance use and mental health among Veteran populations. Notably, most of the existing research on substance use disorders among Veteran populations has focused on alcohol or tobacco use, or has examined substance use disorders as a general ploy-substance group class. As a result, there is little research directly focused on cannabis use and its disorders.

Although some work has suggested that rates of cannabis use disorders are lower among Veteran populations in comparison to rates noted in general population studies (Compton et al., 2004; SAMSHA, 2011), the prevalence of cannabis use disorders among Veterans have been on the rise over the past decades (Bonn-Miller, Harris, & Trafton, 2012; Ritter, Clayton & Voss, 1985). For example, in a recent study of patients receiving services at the Veterans Administration, rates of cannabis use disorders were 0.66% in 2002 ($n$ = 12,907) and 1.05% in 2009 ($n$ = 34,325) – nearly a 60% increase in diagnoses rates (Bonn-Miller, Harris, et al., 2012). One important overarching caveat to this work is that reporting of illicit substance use among military personnel -- active duty and Veterans -- may involve the minimization or denial of cannabis use (i.e., a systematic reporting bias; Institute of Medicine, 2006; Skidmore & Roy, 2011). That is, military personnel may not want to acknowledge using cannabis because of perceived or real negative consequences (e.g., loss of benefits, social criticism; Skidmore & Roy, 2011). This reporting issue may have influenced some of the general trends reported in past work (e.g., Compton et al., 2004).

Existing work on Veteran populations indicates that rates of past year cannabis use among Veterans seeking behavioral health treatment were approximately 11.5% (Goldman et al., 2010). This study also identified that psychological disorders (e.g., mood, anxiety) and other substance use (e.g., alcohol, tobacco) were significantly related to an increased risk for cannabis use (Goldman et al., 2010). In 2009, nearly three-fourths (71.4%) of Veterans meeting criteria only for cannabis use disorders, but not other illicit substance use disorders, met criteria for an additional Axis I psychiatric disorder (Bonn-Miller, Harris, et al., 2012). The most common diagnoses were alcohol use disorders (52.2%), posttraumatic stress disorder (PTSD; 29.1%), depression (23.2%), schizophrenia (6.7%), generalized anxiety disorder (GAD; 3.0%) and panic disorder (1.9%; Bonn-Miller, Harris, et al., 2012); these rates of psychopathology exceed those found among the non-Veteran cannabis dependent individuals (Stinson et al., 2006). Other work suggests that Veterans with cannabis use disorders, in comparison to Veterans with alcohol or other (non-cannabis) substance use disorders, have higher rates of psychopathology (Bonn-Miller, Harris, et al., 2012).

To date, only a few studies have examined cannabis use outcomes as a function of emotional distress among Veterans. One recent study examined substance use among Veterans, after residential treatment for PTSD (Bonn-Miller, Vujanovic, & Drescher, 2011). Results indicated that lower levels of change in PTSD symptoms during treatment, especially avoidance and hyperarousal symptoms, were predictive of higher rates of cannabis use, but not alcohol or cocaine, at 4 months post-treatment. A follow-up study examined the effect of cannabis discontinuation at entry of residential treatment for PTSD on treatment outcomes (Bonn-Miller, Boden, Vujanovic, & Drescher, 2011). The

presence of a cannabis use disorder at treatment entry was predictive of poorer PTSD treatment outcomes; specifically, smaller changes in avoidance/numbing and hyperarousal symptoms post-treatment were observed.

Limitations

Although promising, existing work on emotional distress and cannabis use and its disorders is highly limited. Indeed, there are only a limited number of existing studies completed to date that have examined this cannabis-emotion relationship. Of the existing work, there are at least four other key limitations.

First, existing work has not addressed the role of emotional distress in regard to cannabis use–related negative reinforcement-based cognitive processes (i.e., relaxation/tension reduction expectancies, coping motives) or problems associated with use. Thus, there is no empirical knowledge addressing the role of panic or depressive symptoms in terms of cannabis expectancies, motives, or problems in cannabis use.

Second, little to no existing work has addressed the role of emotional distress in regard to short- and long-term cannabis quit outcomes. The existing work has primarily considered lapse and relapse outcomes; however, from a harm–reduction framework (Blume, 2012), reduction of use is an alternative for those not choosing abstinence. Examining trajectories of change in the quantity and frequency of cannabis use are another clinically-relevant index of cannabis use outcomes.

Third, of the studies that do examine emotional distress in relation to cannabis use and processes, the synergistic effects of depressive and panic symptomology have not been examined. Theory and research suggests anxiety and depressive symptoms and disorders often occur at the same time (i.e., comorbidity; Watson, 2005), and often co-

occur with cannabis use and its disorders. Thus, there is broad-based evidence of multi-morbidity (Brown & Barlow, 2009). The interaction between the panic and depressive symptoms may confer greater relative risk for poor cannabis use outcome and use processes than either symptom dimension alone. This type of logic is in line with recent transdiagnostic approaches for anxiety-depression whereby multiple symptom dimensions (across depressive and anxiety spectrums) are targeted in one therapeutic model (Farchione et al., 2012).

Fourth, the existing work on cannabis-emotional distress linkages has been limited in the participants studied (e.g., general population, college students, select clinical patients). As indicated above, military Veterans represent a highly vulnerable sub-set of the population that is relatively un-studied in regards to cannabis and emotional distress. Of those studies that do examine Veterans, they are largely limited to studies of diagnostic-specific psychopathology (e.g., PTSD).

## Current Study

The current study aims to build on the existing research on emotional distress as it relates to cognitive-based cannabis relevant processes (expectancies and motives), cannabis-related problems, and cannabis quit behavior, among a sample of Veterans participating in a cannabis self-quit study. Based on affective comorbidity work (Mineka, Watson, & Clark, 1998), it is imperative to examine the role of anxiety and depressive symptoms concurrently from a main effect and interactive perspective in order to comprehensively explore their potential individual and synergistic effects. Aligned with this approach, the present study aims to explore the panic and depressive symptoms at a main effect and interactive level of analysis for the criterion variables. To our knowledge,

this is the first test of an interactive model for cannabis use disorder using affective distress indices, and therefore, represents an incremental step forward in cannabis-psychiatric disorder comorbidity research by utilizing an integrative rather than singular model of affective risk. Based on the existing body of research and above-mentioned limitations, the aims of the current study are threefold:

(1) To characterize base rates of psychopathology and panic and depressive symptoms among cannabis dependent Veterans undergoing a self-guided quit attempt. Based on previous literature, it is hypothesized that psychiatric co-morbidity and emotional distress will occur at rates greater than those reported among the non-Veteran, cannabis dependent populations completed via a benchmarking approach.

(2) To examine the main and interactive effects of emotional distress indices on (a) cannabis expectancy outcomes; (b) cannabis use motives; and (c) cannabis-related problems. It is hypothesized that greater levels of emotional distress symptoms will be associated with greater relaxation/tension reduction expectancies, coping-oriented motives, and cannabis-related problems and higher levels of both emotional distress indices will be predictive of the highest degree of negative-reinforcement cognitive processes and problems.

(3) To examine the main and interactive effects of emotional distress indices on short- and long- term cannabis quit behavior. It is hypothesized that higher emotional distress symptoms will be predictive of poorer short- and long-term cannabis cessation outcomes as measured by (a) time to lapse, (b) time to relapse, and greater average cannabis use trajectories as indexed by (c) average cannabis use on using occasion (measure of quantity), and (d) percent days abstinent (measure of frequency); the

interaction of emotional distress indices (higher panic and depressive symptoms) are expected to be associated with the poorest quit outcomes.

## Method

### Participants

Participants ($n$ = 105; 94.6% male; $M_{age}$ = 51.2, $SD$ = 10.03) were cannabis dependent United States Veterans participating in a cannabis self-quit study. Veterans were recruited through flyers posted throughout the Palo Alto Veterans Affairs Medical Center. Eligible participants were Veterans, met criteria for a cannabis dependence disorder (based on DSM-5 criteria), reported motivation to quit of at least 5 on a 10-point rating scale, and expressed interest in making a serious cannabis self-quit attempt. Participants were excluded based on (1) a recent decrease in daily cannabis use (by ≥ 25%) in the past month, (2) pregnancy or current breastfeeding, (3) current suicidal ideation, and (4) limited mental capacity and/or inability to provide informed written consent. Due to missing data on the criterion or predictor variable, a reduced sample was used for the current study ($n$ = 100).

Included participants were 96.0% male and averaged 50.90 ($SD$ = 9.96) years of age. The sample was ethnically diverse: the majority of the sample identified as White and African-American (36.0% each), followed by Hispanic (14.0%), Asian (1.0%), other (12.0%), and not reported (1.0%). Approximately one-third (42.0%) of the participants were divorced or separated, 26.0% were never married, 23.0% were married or cohabitating, 5.0% were widowed, and 4.0% did not report their status. In regard to educational attainment, about one-fourth of the sample completed high school or less (23.0%); the majority of the sample completed part or all of a two- or four-year college (70.0%), or part or all of graduate school (7.0%). Participants were from three different branches of the military (i.e., Army, Navy, Marines), and most served during the 1960's-

1990's in either wartime or peacetime (68.0%), others served within the past decade in Operation Enduring Freedom or Operation Iraqi Freedom (OEF/OIF; 9.0%); data were unavailable for the remaining 23.0% of the sample.

Measures

*Structured Clinical Interview for DSM-IV Disorders* (SCID-I; First, Spitzer, Gibbon, & Williams, 1996). The SCID-I is a clinician-administered semi-structured diagnostic assessment of Axis I psychopathology based on the DSM-IV-TR diagnostic guidelines. The SCID-I has good psychometric properties including validity and inter-rater reliability (Lobbestael, Leurgan, Arntz, 2011; Shear et al., 2000). In the current study, all diagnostic assessments were audio-recorded and reviewed by the study principle investigator for reliability and diagnostic accuracy.

*Inventory of Depression and Anxiety Symptoms* (IDAS; Watson et al., 2007). The IDAS is a 64-item self-report measure of symptoms of major depression and related anxiety disorders. Respondents are asked to rate the degree to which they have experienced symptoms in the past two weeks, scored on a 5-point Likert-type scale (1 = "not at all" to 5 = "extremely"). This measure yields two broad scales (General Depression and Dysphoria) and ten symptom specific subscales including: Suicidality, Lassitude, Insomnia, Appetite Loss, Appetite Gain, Ill Temper, Well-Being, Panic, Social Anxiety, and Traumatic Intrusions. In the current study, two subscales (General Depression [20 items] and Panic [8 items]) will be used as predictor variables in Aims 2 and 3. Psychiatric populations have been found to average scores of 56.04 (*SD* = 15.42) on the General Depression subscale (possible range = 20-100) and 15.09 (*SD* = 6.10) on the Panic subscale (possible range = 8 - 40). The IDAS and its subscales have strong

psychometric properties including internal consistency and test-retest reliability, and convergent and discriminant validity (Watson et al., 2007). Internal consistency in the current study was good to excellent for both the General Depression ($\alpha = .90$) and Panic ($\alpha = .89$) subscales.

*Marijuana Smoking History Questionnaire (MSHQ; Bonn-Miller & Zvolensky, 2009).* The MSHQ is a 30-item self-report measure used to assess history and patterns of cannabis use (e.g., age of first use, quantity and frequency of use, quit attempt history). Respondents are asked to estimate their typical quantity cannabis use per occasion based on a visual scale that consists of eight images representing varying increments of cannabis (see Figure 1). This visual cue is used to facilitate standardization of reporting given the concentrations of cannabis can vary depending on individual's use and method of consumption. This measure was used for describing the sample's cannabis use, and has been used successfully in previous studies in a similar manner (Bonn-Miller & Zvolensky, 2009).

*Marijuana Effect Expectancies Questionnaire (MEEQ; Schafer & Brown, 1991).* The MEEQ is a 70-item self-report questionnaire that assesses current thoughts, feelings and beliefs about cannabis, rated on a 1 ("Disagree Strongly") to 5 ("Agree Strongly") scale. The MEEQ yields 6 subscales, which include three with positive effects [relaxation/tension reduction (9 items; e.g., "I get a sense of relaxation from smoking marijuana"); social/sexual facilitation (10 items; e.g., "I am more sociable when I smoke marijuana"), and perceptual/cognitive enhancement (9 items; e.g., "I become more creating or imaginative on marijuana")], two with negative effects [cognitive/behavioral impairment (13 items; e.g., "Marijuana slows thinking and actions") and global negative

effects (10 items; e.g., “Marijuana can make my feelings from happy to sad”)], and one with neutral effects [craving/physical effects (6 items; e.g., “Marijuana makes me hungry”)]. This measure has strong documented psychometric properties including good test-retest reliability, and convergent and divergent validity (Schafer & Brown, 1991). In the current study, internal consistency for the MEEQ is excellent (α = .94), and good to very good across all subscales: perceptual/cognitive enhancement (α = .75), craving/physical effects (α = .78), social/sexual facilitation (α = .77), relaxation/tension reduction (α = 79), cognitive/behavioral impairment (α = .87), and global negative (α = .90).

*Marijuana Motives Questionnaire (MMQ; Simons et al., 1998).* The MMQ is a 25-item self-report questionnaire that assesses motivation for using cannabis. Respondents are asked to rate the degree that they use cannabis for each specific reason, on a scale ranging from 1 (“almost never/never”) to 5 (“almost always/always”), and yields five subscales: Enhancement (e.g., “because it’s exciting”), Coping (e.g., “to forget my worries”), Social (e.g., “because it makes social gatherings more fun”), Conformity (e.g., “to fit in with the group I like”), and expansion (e.g., “to expand my awareness”). Each subscale on the MMQ is comprised of 5 items and scores can range from 5-25). This measure has strong concurrent and discriminant validity and internal consistency (Simons et al., 1998). In the current study, internal consistency for the MMQ was excellent (α = .92), and good to excellent across all subscales: enhancement (α = 78), coping (α = .81), conformity (α = .88), social (α = .89), and expansion (α = .92).

*Marijuana Problems Scale (Stephens, Roffman, & Curtain, 2000).* The MPS is a self-report questionnaire that evaluates problems experienced in the past 90 days related

to cannabis use. Respondents are asked to rate 19 different problems based on being "never a problem," a "minor problem," or a "major problem." A total numeric score was computed based on the number of problems endorsed (either minor or major), with a possible range of 0 – 19. The MPS was used as one of the criterion outcomes for Aim 2. The MPS has strong internal consistency and has been frequency used to assess cannabis dependence severity and use outcomes (Stephens et al., 2000). The internal consistency for the MPS in the current study was excellent ($\alpha = .95$).

*Motivation to Quit Scale.* The motivation to quit scale is based on the stages of change research and used to determine participant's motivation to quit cannabis use prior to study enrollment. Participants are asked rate how interested they were in quitting cannabis on a scale from 0 ("I enjoy using marijuana and have decided not to quit using marijuana for my lifetime") to 10 ("I have quit using marijuana and I will never use again"); scores $\geq 5$ ("I often think about quitting using marijuana, but I have no plans to quit") were required for participation in the quit study.

*Timeline Follow-Back Interview* (TLFB; Sobell & Sobell, 1992). The TLFB is a calendar-based assessment of substance use, in which data are collected using clinician-guided retrospective recall. Participants are encouraged to use notable events (e.g., birthdays, holidays, special events) and patterns of use (e.g., weekends versus week days, locations, time of day) to complete the calendar. The TLFB was conducted at baseline for the 90-days prior, and at each follow-up visit. Notably, TLFB data from the 14-days prior to the quit attempt will be utilized as "pre-quit data", instead of the full 90-days, in order to match the evaluated time frame of the IDAS, the predictor variable. The TLFB data was employed to document pre-quit substance use behavior (cannabis, alcohol, and

tobacco) and to compute a series of outcome variables including time to lapse, time to relapse, mean cannabis use per using occasion and percent days abstinent. These variables are described in detail in the *Data Analytic Strategy*, below. This form of data collection has been found to have very strong psychometric properties up to 90-days, including excellent inter-rater reliability, test-retest reliability, and strong convergent validity based on collateral interviews (Carey, 1997; Norberg et al., 2012; Maisto, Sobell, Cooper, & Sobell, 1982). In the current study, internal consistency was excellent pre-quit ($\alpha = .97$) and at all follow-up time points (all $\alpha$'s $> .93$).

Procedure

Potentially eligible Veterans were screened via a brief telephone interview, and then were scheduled for an in-person baseline appointment one day prior to the day they were willing to undergo a serious self-quit attempt. At baseline, all participants provided signed informed consent prior to participation in any study activity. A highly trained research assistant or graduate student completed the semi-structured diagnostic assessment to determine a cannabis dependence diagnosis and presence of any additional Axis I psychiatric disorders. Additionally, TLFB was completed for the 90-days prior to baseline. Participants completed the self-report measures as part of a larger battery of assessments. Upon departure, eligible participants were instructed that their quit day would begin at midnight that night.

Follow-up visits were completed weekly post quit-day for one month (Weeks 1 – 4) and then occurred monthly for up to 6-months post quit-day (Months 2 - 6). Thus, a total of 10 visits were completed: pre-quit and nine follow-up appointments. At each follow-up visit, the TLFB was completed. Participants were compensated $75 for

completion of the baseline appointment and $15 for each follow-up. To bolster retention, participants were able to earn a $30 bonus if they attended all assessment visits. This study was approved by the Institutional Review Boards at the Palo Alto VA Medical Center and Stanford University.

Data Analytic Strategy

The distribution of the data was first examined to determine whether the data fulfilled the required assumptions of parametric, regression-based analyses (i.e., normality, linear). The only variable that required transformation was pre-quit cannabis frequency (percent days abstinent) due to a kurtoic distribution (kurtosis = 7.59). All values for this variable were multiplied by a constant then a log (ln) transformation was used in SPSS.

Next, patterns of missing data on the TLFB were examined due to the prospective structure of the data. Attrition rates were 10.5% at week 1, 19.0% at week 2, 21.9% at week 3, 24.8% at week 4, 26.7% at month 2, 25.7% at month 3, 30.5% at month 4, 37.1% at month 5, and 39.0% at month 6; 43.8% of the participants had one or more missing follow-up data points. Overall, 26.0% of all possible follow-up outcome values in the dataset were missing. These rates are comparable to those documented in previous cannabis outcome studies (Marijuana Treatment Project Group, 2004). When missing outcome data exceed 10%-20% in the entire dataset (26.0% in the current study), it is recommended to conduct missing value pattern analyses in order to determine how to handle the missing values in primary outcome analyses (Hall et al., 2001).

A missing pattern analysis identified three general patterns: (1) no missing outcome data (55.2% of cases); (2) all missing data after a certain follow-up time point

(i.e., right-censored; 32.4%); and (3) sporadic missing follow-up data (12.4%). A follow-up analysis of covariance (ANOVA) was conducted in order to examine differences in relevant baseline covariates and predictor variables by missing data pattern (coded 1, 2, or 3). Contrast coefficients were used to specifically compare group 1 (no missing data) to groups 2 and 3 (presence of any missing data). Results indicated no statistically significant differences on all tested variables including pre-quit cannabis use per using occasion, pre-quit percent days abstinent, number of Axis I diagnoses, or baseline IDAS subscales (General Depression or Panic).

In order to address the study Aim 1, frequency distributions were used to document the prevalence of Axis I co-morbidity and mean IDAS subscales scores (General Depression and Panic).

To address study Aim 2, Pearson correlations were conducted to examine the strength of the association between general depressive and panic symptoms and each of the criterion outcome variables: tension/relaxation expectancies for use, coping-oriented motives for use, and number of problems related to cannabis use. Next, a series of hierarchal regression models were conducted to examine the main and interactive effects of IDAS-Depression and Panic on the three criterion outcome variables. In the first step of each model, pre-quit quantity of cannabis use and other substance use (e.g., tobacco and alcohol) were entered as covariates. In the second step, all other non-criterion subscales on the MEEQ or MMQ (this step was not included for marijuana problems; MPS). In the next step, mean centered IDAS-Depression and IDAS-Panic were entered to examine the main effects of these variables on the criterion outcomes. In the final step, the interaction term between IDAS-Depression and IDAS-Panic was entered.

Any significant interactions were explored statistically (Cohen & Cohen, 1983) and graphically (Holmbeck, 2002). First, a specific value was determined for each predictor variable (i.e., 1 SD +/- mean for the two emotional distress variables) and entered into the regression equations associated with the described analysis). Then, follow-up regression analyses were conducted to examine the significance of the simple slopes and interactions (Aiken & West, 1991, p. 19; see Holmbeck, 2002 for a detailed example). In these models, the main effect, conditional effect, and interaction are entered simultaneously. Two models are conducted for each of the conditional variables (high and low), which generate slopes that can be plotted.

To address Aim 3, the role of emotional distress on cannabis use quit behavior was examined. Based on the commonalities of between-subject variability in patterns (frequency) and extent (quantity) of cannabis use, it can sometimes be informative to examine multiple indices of use when characterizing cannabis outcomes. Unfortunately, there are currently no clear, empirical or standardized guidelines delineating the ideal procedures for measuring cannabis use outcomes (Allsop, Carter, & Lento, 2010; Peters, Nich & Carroll, 2011; Norberg et al., 2012). As a result, the current study utilized four indices that have been routinely used in outcome research, including: (a) lapse (any use post-quit attempt; Moore & Budney, 2003), (b) relapse (i.e., cannabis use on at least four days during a seven day period; Moore & Budney, 2003), (c) average cannabis use per using occasion, and (d) percent days abstinent.

In order to examine Aims 3a and 3b, a series of Cox proportional-hazard regression analyses were used to model (a) time to lapse and (b) time to relapse. This analytic approach estimates and models the distribution of "survival" time it takes before

an event (lapse/relapse) occurs (Cox, 1972). This strategy was selected, in part, for its robustness to censored data. To prepare the data for these analyses, variables were computed from the TLFB data. Two dichotomously-coded variables were created based on the status of the examined event (i.e., occurrence of "any lapse" or "any relapse"). Then, the time to lapse was coded based on the number of days elapsed since quit-day before the first lapse. Time to relapse was coded based on the number of day elapsed since quit-day before the first day of the seven day period that the relapse occurred.

Based on recommendations by Hall et al. (2001), three approaches were employed to adjust for missing data. First, a complete-case analysis was used, which consists of removing any cases with incomplete data from the primary analyses; however this approach is done at the cost of significantly decreased power. A second approach is model-based multiple imputation, which involves randomly generating observations below the detection limit using sample observed values (e.g., Krishnamoorthy, Mallick, & Mathew, 2009). This procedure is criticized for potentially biasing results. Third, it can be assumed that the presence of missing data indicates the occurrence of the outcome event (i.e., cannabis use); however, this approach may increase Type-I and II error rates. For the present study, analyses were completed using all three strategies and compared.

Next, study Aims 3c and 3d were examined using Hierarchical Linear Modeling (HLM). This regression-based analytic approach accounts for inter-dependence of prospective outcome data (TLFB) by utilizing maximum likelihood estimation of error. HLM estimates the slope of the outcome data and rate of change over time in as a function of the predictor variable. Notably, this approach is robust to missing data. Two separate models were conducted to examine emotional distress (IDAS-Panic and IDAS-

Depression) as time-invariant predictors of the change in the trajectory in (c) average cannabis use on a using occasion and (d) percent days abstinent, over time. Identified variables that could affect relations between the predictor and criterion variables (tobacco and alcohol use) were entered into the models as covariates.

Data were re-structured from a multivariate (subject data by rows) to a univariate format (subject data by columns). The latter format stacks data such that each time point of the dependent variable is coded as a different case subsumed under a single transformed variable. As such, the TLFB criterion variables were transposed into two cannabis use outcome variables (average cannabis use per using occasion and percent days abstinent), indexed by a variable "time." The "time" variable contained ten levels, coded by the last day number of the assessment period since quit-day in order to accurately represent the differential time intervals in assessment, as follows: 14-days prior to quit-day; coded "0"); one week post-quit attempt (days 1-7; coded "7"); two weeks post-quit attempt (days 8-14); three weeks post-quit attempt (days 15-21; coded "21"); four weeks post-quit attempt (days 22-28; coded "28"); two months post-quit attempt (days 29-56; coded "56"); three months post-quit attempt (days 57-84; coded "84"); four months post-quit attempt (days 85-112; coded "112"); five months post-quit attempt (day 113-140; coded "140"); six months post-quit attempt (days 141-168; coded "168"). Notably, it is standard to covary for baseline (i.e., pre-quit) levels of the criterion variable to control of group differences; however, due to the non-randomized nature of the current study and in effort to fully model cannabis use trajectories over time, mean cannabis use per using occasion for the 14-days prior to the quit attempt was included as the first level of the outcome. HLM analyses were conducted using R software (v. 2.15.1).

# Results

## Aim 1: Pre-Quit Characteristics

During the 14 days prior to quit-attempt, the majority of the sample reported daily cannabis use (78.0%), and mean quantity of cannabis use per using day averaged 6.13 (*SD* = 2.08). Typical means of cannabis consumption included via joint (62.0%), bowl (14.0%), bong (9.0%), one-hitter (6.0%), and vaporizer (3.0%), with 6.0% choosing to not report on their primary method of use.

Veterans reported cannabis initiation and regular use at 16.05 (*SD* = 5.25) and 20.32 (*SD* = 9.40) years of age, and averaged 28.23 (*SD* = 13.24) years of regular cannabis use. The majority of Veterans indicated typically using cannabis by themselves (56.0%). The majority of the sample (86.0%) reported at least one "serious" previous quit attempt. Most Veterans reported high motivation to quit ("I definitely plan to quit using marijuana in the next 30 days), averaging 7.17 (*SD* = 1.37) out of the 10-point rating scale. Notably, motivation to quit rating was not significantly correlated with any pre-quit predictor or outcome variables.

The majority (77.0%) of Veterans had at least one current comorbid Axis I psychiatric diagnosis, with an average number of 1.77 (*SD* = 1.54) additional diagnoses (not including cannabis dependence disorder). Anxiety disorders were the most common co-occurring psychiatric disorder (57.0%) followed by mood (40.0%) disorder. Specifically, rates of panic disorder (with or without agoraphobia) and major depressive disorder were 14.0% and 19.0%, respectively. Approximately one-third of the sample (32.0%) met criteria for a current non-cannabis substance use disorder. Rates of any

tobacco and alcohol use pre-quit day 59.0% and 54.0%, respectively. The rates of specific co-morbid affective and substance use disorders are presented in Table 2.

In regard to dimensional measures of emotional distress (indexed via the IDAS), the General Depression subscale averaged 48.48 (*SD* = 16.57), which is slightly lower than the average rating for psychiatric patients but still fell well within one standard deviation limits (*M* = 56.04, *SD* = 15.42; Watson et al., 2007). On the IDAS-Panic, scores averaged 13.74 (*SD* = 6.50), which is comparable to average ratings for psychiatric samples (*M* = 15.09, *SD* = 6.10; Watson et al., 2007). IDAS-General Depression and Panic were significantly inter-correlated (*r* = .69), and as expected, were strongly correlated with greater Axis I co-morbidity (*p's* < .001). Interestingly, the two emotional distress variables were not significantly correlated with cannabis use behavior prior to quit-day (quantity and frequency), alcohol or tobacco use, or motivation level to quit (all *p's* > .05).

Self-reported problems related to cannabis use were highly common with 79.0% of the sample reporting one or more problems. The average number of problems experienced was 6.78 (*SD* = 6.04; out of 19) and the most common "serious" problems were related to productivity (procrastination [23.0%], financial difficulties [18.0%], loss of job [15.0%], lower productivity [14.0%], missing days of work/class [11.0%]), and relationships (family [19.0%], partner [17.9%] and friends [14.0%]). Serious physical and emotional problems also were reported, including lower energy (16.0%), feeling bad about use (15.0%), lower self-esteem (12.0%), lack self-confidence (11.0%), withdrawal (10.0%), medical problems (10.0%), memory loss (8.0%), difficulty sleeping (6.0%), and

blackouts/flashbacks (2.0%). Additionally, 11.0% of participants reported serious legal problems due to cannabis use.

Aim 2: Cannabis Use Expectancies, Motives, and Problems

Descriptive information and bivariate correlations are presented in Table 3. IDAS-Depression was significantly associated MEEQ-Tension Reduction/Relaxation ($r$ = .30, $p$ < .01) and MMQ-Coping ($r$ = .22, $p$ = .03), however the IDAS-Panic was not associated with these variables. As expected, both IDAS-Depression and Panic were significantly related to cannabis use problems ($r$'s = .21-.28, $p$'s < .05). Next, hierarchical regressions models were conducted to examine the main and interactive effects of the emotional distress indices on the MEEQ-Tension Reduction/ Relaxation, MMQ-Coping, and MPS. Please see Table 4 for regression results.

Regarding the MEEQ-Tension Reduction/Relaxation subscale, results indicated that the model accounted for 66.0% of the overall variance [$F$(11,84) = 14.83, $p$ < .001]. Step 1 of the model accounted for a non-significant 5.8% of variance. Step 2 accounted for 55.6% of variance, over and above that from step 1, with all MEEQ subscales as significant predictors ($p$'s < .04), with the exception of MEEQ-Cognitive/Behavioral Impairment. Step 3 accounted for a negligible amount of additional variance (0.7%). In the final step, the interaction accounted for a statistically significant and unique 3.9% of variance in MEEQ-Tension Reduction/Relaxation subscale (β = .27, $p$ = .003). As indicated in the *Data Analytic Strategy*, two conditional variables (low and high IDAS-Panic) were calculated as the respective IDAS-Panic value +/- 1 SD: low IDAS-Panic (IDAS-Panic + 6.496) and high IDAS-Panic (IDAS-Panic - 6.496). Interaction terms were created to include the new conditional variables (low/high IDAS-Panic scores), by

multiplying each by IDAS-Depression. Post hoc regression analyses were conducted to include IDAS-Depression, the conditional variable (low/high IDAS-Panic scores), and their interaction. As seen in Figure 2, MEEQ-Tension Reduction/Relaxation was highest among those with high IDAS-Depression and high IDAS-Panic scores, and was lowest among those with low IDAS-Depression and low IDAS-Panic scores. However, neither the main effects nor the interaction was significant.

Regarding the MMQ-Coping subscale, results indicated that the model accounted for 41.8% of the overall variance [$F(10,82) = 5.849$, $p < .001$]. Step 1 of the model accounted for 0.5 % of variance. Step 2 accounted for 36.5% of variance, with MMQ-Social being the only significant predictor ($\beta = .45$, $p = .001$). Step 3 accounted for an additional 1.3% of variance; however, neither of the main effects of IDAS-Depression and Panic were significant. In the final step, the interaction between IDAS-Depression and Panic predicted a statistically significant 3.5% additional variance in the MMQ-Coping ($\beta = -.26$, $p = .03$). Follow-up probing analyses of the simple slopes and interactions were conducted. Post hoc regression analyses were conducted to include IDAS-Depression, the conditional variable (low/high IDAS-Panic scores), and their interaction. These analyses revealed a marginally significant main effect of IDAS-Depression when IDAS-Panic was low ($t = 1.85$, $\beta = .60$, $p = .068$), and a significant main effect for IDAS-Depression when IDAS-Panic was high ($t = 2.03$, $\beta = .33$, $p = .045$). As seen in Figure 3, MMQ-Coping was highest among those with high IDAS-Depression and low IDAS-Panic scores, and was lowest among those with low IDAS-Depression, regardless of IDAS-Panic scores. The interaction between these predictors was not significant.

Regarding the MPS, analyses revealed that the model accounted for 13.6% of the overall variance and was statistically significant [$F(6, 90) = 2.35$, $p = .037$]. Step 1 of the model accounted for a non-significant 2.9% of variance. Step 2 accounted for an additional 9.8% of variance, with IDAS-Depression uniquely and significantly related to the MPS subscale above and beyond the covariates at Step 1 of the model ($\beta = .34$, $p = .015$). Step 3 accounted for an additional 0.9% of variance, but the interaction between IDAS-Depression and Panic was not significant.

Aim 3: Cannabis Quit Behavior

Eighty-nine percent of the sample lapsed after the quit attempt, with a median survival time of 2.5 days. Thus, lapsing was highly prevalent. Of those who lapsed, 86.5% lapsed by the first 28 days post-quit attempt. Regarding relapse, 78.0% of the sample relapsed, with a median survival time of 9.5 days. Of those participants who relapsed, 79.5% relapsed within the first 28 days. Figure 4 provides a plot of the cumulative survival proportion over time[1]. Given the small proportion of cannabis first-time lapses and relapses that occurred later in follow-up, only the 28 days post-quit day were considered in the lapse and relapse survival analyses. That is, there is little to no reason to empirically explore lapse/relapse behavior for the present sample beyond 28 days due to the highly disproportionate number of 'early' lapse/relapse behavior.

Two hierarchical proportional hazards Cox regression models were conducted (for lapse, and then, relapse). In both models, pre-quit cannabis use frequency (percent days abstinent) and alcohol and tobacco use status were entered as covariates in the first

[1] All three approaches for handling of missing data were evaluated: approaches 2 and 3 yielded similar results, whereas when using the first approach (complete-case analytic approach), cox regression models were not significant due lack of power ($n = 49$). Due to the similarities in results from approaches 2 and 3, one set of results are presented in text (from strategy 3; i.e., assuming that the presence of missing data indicates the occurrence of the outcome event (i.e., cannabis use).

step. In the second step, both emotional distress variables (IDAS-Depression and IDAS-Panic) were entered as the primary predictors of survival time (number of days) to cannabis lapse or relapse, post quit attempt. In the third step, the interaction between the emotional distress variables was added.

Results are presented in Table 4. For the first model (time to lapse), the overall model was not significant [$x^2(6) = 9.28$, $p$ = ns]. Regarding time to relapse, the overall model was significant [$x^2(6) = 14.52$, $p = .024$], however none of the covariates entered in Step 1 were significant predictors. In Step 2, higher scores on the IDAS-Panic were associated with an increased risk of relapse, however this effect was not significant (Hazard = 1.05, $p = .07$). In the last step, the interaction was not significant.

Next, 'longer-term' trajectories of cannabis use were examined and data were analyzed hierarchically in two models. In the first model, mean cannabis use per using occasion was considered over time, as a function of the main and interactive effects of baseline emotional distress (IDAS-Depression and IDAS-Panic). In the second model, percent days abstinent were considered over time, as a function of the main and interactive effects of baseline emotional distress (IDAS-Depression and IDAS-Panic). Tobacco and alcohol use status were entered as covariates in all models. These linear mixed models were constructed to include the intercept, main effects of the time and IDAS subscales, and interaction between IDAS subscales, and the interactive effects of the slope of the cannabis use outcome measure. Time and subject were entered as random effects and IDAS subscale was entered as a fixed, between-subjects effect. Data are presented graphically in Figure 5.

Regarding quantity of use, there was a significant main effect of time and of IDAS-Panic, such that during the six months post-quit attempt, a significant decrease in mean cannabis use per using occasion was observed ($p$'s < .001) and higher levels of IDAS-Panic were significantly related to greater average quantity of cannabis use ($p$ = .002). The main effect for IDAS-Depression was not significant, but the interaction between IDAS-Panic and IDAS-Depression was significantly predictive of lower average quantity of use. The main or interactive effects of IDAS predictors by time were not significant. Regarding frequency of use, again, there was a significant main effect of time and of IDAS-Panic, such that during the six months post-quit attempt, significant increases in percent days abstinent was observed ($p$'s < .001) and higher levels of IDAS-Panic were significantly related to fewer average percent days abstinent ($p$ = .002). In this model, there was a significant effect of IDAS-Panic by time, such that IDAS-Panic was predictive of fewer percent days abstinent ($p$ = .04) over time, but a non-significant main effect and interactive effect of IDAS-Depression was found over time.

In order better understand the relations between emotional distress and cannabis use trajectories, means on the outcome variables were plotted, across time, as a function of high and low values of the IDAS variable, specified by +/- .05 SD from the mean respectively (Cohen, Cohen, West, & Aiken, 2003). These results are provided in Figure 5. Trends in quantity and frequency of cannabis use over time appear to diverge as a function of high panic and depressive symptomology, especially during the first four weeks post-quit attempt.

## Discussion

There is growing interest in research on cannabis dependence and the factors that may influence the onset, course, and maintenance of this substance use disorder (e.g., Bonn-Miller & Moos, 2009; Buckner et al, 2011). Due to the high rates of comorbidity between psychological disturbance and cannabis use disorders (Stinson et al., 2006), there is good reason to explore the role of negative emotional symptoms as potential risk candidates for cannabis use behavior. The current study sought to build on the existing research by examining the role of panic and depressive symptoms in terms of cannabis use problems, select cognitive-based cannabis processes (motives and expectancies), and cannabis quit behavior among a sample of Veterans participating in a cannabis self-quit study. Veteran populations are important from a public health perspective to study in this context because they often have elevated rates of substance use disorders, psychiatric disorders, suicide, among other health problems (e.g., medical illnesses), compared to general civilian populations (Ilgen et al., 2010, 2012; Wagner et al., 2007).

### Presence of Psychopathology and Emotional Distress among Cannabis Dependent Veterans

The first aim of the study was to document the extent of psychopathology and negative emotional distress among this Veteran sample. Here, 77% of the sample met criteria for a current psychiatric disorder, excluding cannabis dependence. This observation is generally consistent with previous studies that have found base rates of approximately 70% for psychopathology among Veterans with cannabis use disorders (Bonn-Miller, Harris, et al., 2012). Co-occurring substance use and disorders also were highly prevalent in the current sample. Indeed, 32.0% of the sample met criteria for an

additional (non-cannabis) substance use disorder. Notably, 87.0% met criteria for a past of non-cannabis substance use disorder. Additionally, there were markedly high rates of tobacco use (59.0%) among the present sample. This rate of tobacco use among cannabis dependent persons is important clinically, as some work has found that cannabis use maintains cigarette smoking (Amons, Wiltshire, Bostock, Haw, & McNeil, 2004; Highet, 2004) and predicts the development of nicotine dependence (Patton, Coffey, Carlin, Sawyer, & Lynskey, 2005). These results broadly document the 'commonality' of co-occurring substance use disorders among Veterans. Such findings underscore the importance of research aimed at understanding the nature of substance use disorders among this Veteran population.

Anxiety and mood disorders also were common among Veterans in the current sample. More than half (57.0%) of the sample met the diagnostic criteria for a current anxiety disorder. When benchmarked against cannabis dependent civilians, these rates are markedly higher (57% among military versus 43.5% among civilians; Stinson et al., 2006). This observation may, in part, be related to the common occurrence of PTSD among this Veteran sample (39.0%). Such a finding is not surprising given the elevated base rates of PTSD among Veterans populations in general (Magruder & Yeager, 2009) and the greater prevalence of PTSD with substance use disorders in particular (Kessler, Sonnega, Bromet, & Hughes, 1995). In the current sample, 40.0% of Veterans met criteria for a current mood disorder; 36.0% of which consisted of major depressive disorder or dysthymia. These results add to the wealth of empirical evidence documenting the co-occurrence of mood and anxiety disorders with cannabis dependence

among military and civilian samples (e.g., Agosti et al., 2002; Buckner et al., 2012; Chen et al., 2002; Cougle et al., 2011; Stinson et al., 2006).

In terms of dimensional indices of panic and depression, the degree of emotional distress was generally comparable to (for IDAS-Panic) or slightly lower (for IDAS-Depression) than levels documented among other civilian clinical populations (Watson et al., 2007). Given the extent of psychopathology evident among the current sample, it is unlikely that emotional distress is *actually lower* than in comparison to other clinical samples. Moreover, it is possible that symptom reporting may have been slightly minimized by participants in the current sample because past work has found Veterans with mental health concerns whether active duty or Veterans often cite stigma-related fears in regard to symptom reporting (Skidmore & Roy, 2011). These data, in conjunction with the diagnostic findings reviewed earlier, document cannabis dependent Veterans experience clinically concerning levels of emotional distress and dysfunction.

Negative Reinforcement-Based Cognitive Processes

One of the most consistently supported observations in the substance use disorder research is that expectancies and motives for substance use frequently influence the course of substance use (Comeau et al., 2001; Zvolensky et al., 2006). Emerging cannabis-focused work has suggested negative reinforcement-based expectancies and motives for use are important explanatory cognitive processes related to the maintenance of cannabis use (Bonn-Miller, Vujanovic, & Zvolensky, 2008; Galen & Henderson, 1999; Simons & Arens, 2007). Yet, this work has not focused expressly on Veterans. The current study sought to fill a gap in the existing literature by examining the role of

emotional distress (panic and depressive symptoms) in terms tension reduction cannabis use expectations and coping use motives among cannabis dependent Veterans.

In terms of expectancies, partially consistent with prediction, the combination of higher levels of both distress indices was significantly associated with the tension reduction/relaxation expectancies (Figure 2) above and beyond the explanatory factors at earlier steps in the model. However, there were no significant main effects for panic and depression; a set of findings that is inconsistent with *a priori* prediction. These data suggest that panic and depressive symptoms can indeed, as expected, interplay (at least concurrently) with one another to confer greater (concurrent) in regard to the expression of tension reduction expectations for cannabis use among Veterans. Thus, if replicated cross-sectionally and extended prospectively, these data urge scholars to focus on 'multi-risk factor' models for tension reduction expectancies for cannabis use. Future work is needed to develop integrated theoretical models of emotional vulnerability for cannabis use that can specify the role and impact of distinct symptom clusters (or dimensions) in regard to expectancies for substance use effects. Moreover, while the present study focused on panic and depressive symptoms, there are clearly a myriad of possible 'interactive models' involving other symptom types (e.g., traumatic stress symptoms, social anxiety symptoms) that warrant consideration and more comprehensive integration.

In regard to coping motives for cannabis use, results were only partially consistent with prediction. Specifically, the interaction between IDAS-panic and depression was significantly related to coping-oriented cannabis use motives. Once again, there were no significant main effects. As with the expectancy results reviewed above, the significant interaction was evident after controlling for quantity of cannabis use, other substance use

(tobacco and alcohol), and other cannabis motives (e.g., expansion) as well the respective as (non-significant) main effects for panic and depressive symptoms. However, in contrast to expectation, higher levels IDAS-depression and lower levels of IDAS-Panic were related to greatest coping-oriented motives (see Figure 3). That is, Veterans were most apt to endorse cannabis use coping motives when depressive, but not panic symptoms, were high.

The form of the observed significant interaction is somewhat inconsistent with existing studies that document the relations between panic-relevant cognitive processes (i.e., anxiety sensitivity) with coping-oriented motives among non-Veteran cannabis using individuals (Buckner et al., 2012). However, some non-cannabis oriented work (i.e., tobacco work) has found that anxiety sensitivity may be a better predictor of coping use motives for use compared to panic attacks (Johnson, Farris, Schmidt, Smits, & Zvolensky, 2012). As documented in the case of tobacco, it is possible that among cannabis dependent individuals, the experience of higher levels of anxiety sensitivity may be more powerful as an explanatory variable of coping use motives than panic sensations (or panic attack histories). For example, a Veteran experiencing frequent panic symptoms (e.g., racing heart) who has lower anxiety sensitivity, may not interpret the panic-relevant symptoms as personally harmful; therefore, he/she may not rely on cannabis to dampen (perceived, objectively, or both) symptoms.

Based on this type of theorizing, in conjunction with the uniform lack of main effects for panic and depressive symptoms, future work would benefit from exploring the role of other symptom dimensions in terms of cannabis use motives among Veterans. It is also possible that specific symptom constellation of panic and depressive symptoms is in

fact better conceptualized as *negative affectivity*, a non-specific, higher-order factor of subjective distress and dissatisfaction that is common to both depression and anxiety, and includes a broad range of negative emotional states, including fear, anger, sadness, and guilt (Watson, 2005). This latent construct is used to help understand and explain the high degree of inter-relatedness between this set of symptoms (Clark & Watson, 1991; Watson, 2005). Given the extent of psychopathology present among Veterans in this sample, it is likely that negative affectivity, broadly, may be predictive of maladaptive cognitive processes. It would be advisable to examine the same models tested in the current study or negative affectivity-based models among non-Veterans to help ensure that the observed null effects were not influenced by a truncated range in emotional distress (i.e., ceiling effect) and to better understand the construct validity of negative affectivity.

Although not the primary aim of the current study, it is noteworthy that all covariates entered in the first step of the regression analyses were unrelated to the criterion variables. These covariates were selected on an a priori theoretical basis based upon previous work (Conner, Gullo, Feeney, & Young, 2011) and integrated theoretical models of substance use and emotion (Zvolensky et al., 2006). Future work could benefit by exploring the role of substance use on expectancies and motives for cannabis use among Veterans and civilian populations.

Together, findings generally suggest that panic/depressive symptoms (or negative affectivity more broadly) may interplay with one another in terms of negative reinforcement expectancies and coping motives for use. If replicated and extended with larger sample sizes and over time, these data suggest that there may be utility better understanding the role of interactive models of emotional risk for cannabis use behavior

for Veterans. This type of work will be most meaningful when more sophisticated, integrated models of cannabis use-psychiatric multi-morbidity are developed.

Emotional Distress and Cannabis-Related Problems

By definition, cannabis use disorders are characterized by the presence of interference and distress related to cannabis use, although cannabis related problems alone are neither sufficient nor necessary to warrant a cannabis dependence diagnosis (APA, 2000). The extent the problems related to cannabis use are experienced has important implications, potentially capturing unique differences between individuals with cannabis dependence vis a vis a dimensional index of severity. The current study documented high rates of cannabis-related problems among the current sample, with the majority of Veterans (79.0%) reporting one or more problems from use, averaging 6-7 problems. It is important to note that the majority of Veterans participating in the current study were older in age ($M_{age}$ = 51.2, *SD* = 10.03). It is possible the Veterans in the present sample had more chronic histories of substance use and many 'disease amplifying factors' (e.g., psychopathology, medical problems, trauma exposure, tobacco use), which could at least partially account the high magnitude of problems recorded. Future work is needed to understand the potential clinical significance of cannabis use problems from a dimensional perspective in regard to its predictive power for other cannabis use processes (e.g., success in quitting, influence on co-occurring substance use). The current data suggest that there is indeed variability in the extent of cannabis use problems even among Veterans who all have a current cannabis use disorder diagnosis.

Results of the affect-based model for cannabis use problems were only partially consistent with prediction. As hypothesized, higher levels of depressive symptoms were

significantly predictive of greater cannabis-related problems after controlling for quantity of cannabis use another other substance use (alcohol and tobacco). This observation is broadly consistent with previous studies (Buckner & Carroll, 2010; Compton et al., 2011). However, in contrast to expectation, there was no significant effect of panic symptoms on cannabis use problems. Thus, depressive symptoms, relative to panic symptoms, may individually be more strongly related to cannabis use problems among Veterans. There also was no evidence of an interaction between depressive and panic symptoms for cannabis use problems. This latter finding is inconsistent with the previously documented interactions for expectancies/motives. It is unclear presently why depressive symptoms may be related to cannabis use problems. One possibility is that experiencing depressive symptoms may contribute to lack of motivated behavior for life activities, especially those dealing with substance use like cannabis use (e.g., financial struggles). Future work could benefit by exploring the specific dimensions of depressive symptoms that may related to specific cannabis use problems, as past substance use-depression work has suggested explanatory specificity for anhedonia relative to other depressive features (Leventhal, Zvolensky, & Schmidt, 2011). Again, it is likely that more sophisticated and integrated models of mood vulnerability are needed for cannabis use behavior.

Again, it is important to point out the non-significant impact of co-substance use on cannabis-related problems. As indicated above, this is somewhat surprising, as it might be expected that multiple substance and more heavy cannabis use would be related to greater problems related to use. However, this polysubstance use finding has not been consistently documented in the literature (Secora et al., 2010). In the current Veteran sample, it appears that cannabis-related problems are unrelated to pre-quit patterns of

cannabis use or co-substance use. Further investigation is needed to more clearly understand what factors impact cannabis-use problems. Based on recent research, it is likely that expectancies and motivations for use may partially explain the relation between some types of affective symptomology (e.g., social anxiety) and problems-related to cannabis use (Buckner & Schmidt, 2008, 2009; Buckner, Zvolensky, & Schmidt, 2012). Therefore, this type of mediation model could be usefully examined among Veterans.

Overall, the current findings provide important information relevant to treatment planning for cannabis dependent Veterans reporting higher levels of depression symptoms. These Veterans may represent a more severe group of cannabis dependent Veterans, and therefore, may benefit from an active cannabis cessation treatment that includes psychoeducation and therapeutic tactics (e.g., behavioral activation) for depressive symptoms in regard to cannabis use problems.

Short- and Long-Term Cannabis Quit Outcomes Among Veterans

A plethora of studies document high rates of lapse and relapse, even after psychological and pharmacological intervention (Budney, Moore, Rocha, & Higgings, 2006; Kadden, Litt, Kabela-Cormier, & Petry, 2007; Marijuana Treatment Research Group, 2004; Stephens, Roffman, & Curtain, 2000). Of the prospective studies examining the role of emotional distress on cannabis outcomes, studies have limited their investigation to a singular index of emotional distress (e.g., trait anxiety; Buckner & Carroll, 2010). The current study sought to address the role of two common and clinically-relevant indices of emotional distress among Veterans with cannabis use disorder.

*Lapse and relapse base rates and patterns of use.* In the current sample, the occurrence of lapse and relapse was highly common (> 70%) and typically occurred in the first month after attempted cessation. In line with previous studies (Moore & Budney, 2003), the current results suggest that cannabis dependent Veterans experience notable difficulties in maintaining sustained abstinence. However, when examining the trajectory of cannabis use over time, significant decreases in the quantity and frequency of use were noted after quit attempt. Specifically, Veterans decreased the quantity of use by nearly half after quit-attempt, and increased the frequency of cannabis free days by about 50%. These novel findings suggest that during an un-aided quit attempt, at least 'acute changes' in cannabis use are possible among cannabis dependent Veterans. Further, it suggests that Veterans in the current sample were indeed interested in changing their cannabis use.

*Lapse.* Contrary to expectation, emotional distress indices were not significantly related to the probability of cannabis lapse. Due to the large majority of lapses occurred on the day immediately following the quit-attempt, it is possible that a more sensitive time-sampling measurement of cannabis use would have better detected within-day variability (e.g., time in minutes/hours to cannabis use). Alternatively, it is possible that depressive and panic symptoms are simply unrelated early quit failure among Veterans. This possibility may be somewhat unlikely, as past work has found using time sampling approaches that negative affect often is an antecedent to cannabis use among active non-Veteran users in a self-guided quit attempt (Buckner et al., 2011).

*Relapse.* Notably, when examining survival time to *relapse*, the overall model was significant. Specifically, greater panic symptoms, but not depressive symptoms or their combination, were related to an increased risk to early cannabis relapse, but this

effect was not statistically significant. While these findings are loosely consistent with other studies that have documented the impact of anxiety symptoms on cannabis re-initiation among civilian populations (Bonn-Miller & Moss, 2009; Buckner & Carroll, 2010; Tournier et al., 2003), the current results should not be over-interpreted. Due to the overall rapid relapse (average 9.5 days post-quit attempt), it is possible the current analyses lacked sensitivity to detect an effect As suggested above, technology-based data collection methodologies may better detect variability in relapse outcomes, and should be considered in future research.

Although not a primary aim, interestingly, co-use of tobacco also was significantly associated with an increased risk to early cannabis relapse, which is consistent with at least one study of cannabis relapse among adolescents (de Dios, Vaughan, Stanton, & Niaura, 2009; Goodman et al., 2010). This finding adds broadly to the existing literature on cannabis-tobacco use inter-relations (Amons et al., 2004; Patton et al., 2005; Ramo, Liu, & Prochaska, 2012).

Together, due the overarching lack of effects in general, future work may benefit by exploring the role of other symptom indices (e.g., social anxiety, posttraumatic stress symptoms) in relapse among Veterans. Also, as with the expectancy and motives for use results, scholars could usefully explore the same panic-depressive symptom model among civilians, as there were markedly high rates of 'early failure' in the current Veteran sample, potentially truncating meaningful variability.

*Patterns of cannabis use during the quit attempt.* Results for patterns of cannabis use in quantity and frequency during a self-guided quit attempt were only partially consistent with *a priori* prediction. Specifically, there was a significant effect for panic

symptoms for frequency of cannabis use over time, but no effect for depressive symptoms or the interaction between panic/depression. These findings suggest that there is indeed merit in exploring the role of panic (and perhaps other anxiety) symptoms in terms of changes in cannabis use while quitting. The results uniquely add to the existing literature on cannabis use-panic relations (Zvolensky et al., 2008). If the present results are replicated and extended to other populations, there may be merit in exploring the role of panic reduction (or, transdiagnostic anxiety) interventions for cannabis dependent persons to facilitate reductions in cannabis use. However, the present data suggest there is less evidence to support the role of further exploration for depression and changes in cannabis use among Veterans. Additionally, results indicated that co-substance use pre-quit day did not significantly influence patterns of cannabis use. Overall, the results appear largely in accord with harm reduction perspectives of substance use among dependent persons (Blume, 2012), which posit abstinence alone may not be the only ‘informative index' of quit behavior.

Other Noteworthy Observations

Beyond the primary outcomes reviewed in detail above, several secondary observations were noted. First, pre-quit cannabis use patterns and co-substance use (alcohol and tobacco) were unrelated to tension reduction/relaxation expectancies, coping motives, and cannabis-related problems. With regard to quit behavior, tobacco use was associated with early relapse, but not overall patterns of post-quit cannabis use. This pattern of results is intriguing and underscores the importance of further understanding the impact of tobacco use on cannabis use, especially in terms of early cessation failure.

Second, the current study exclusively examined two theoretically-relevant

expectancies (tension reduction/relaxation) and motives (coping), based on negative-reinforcement models of substance use (Baker et al., 2003) in conjunction with integrated substance use – emotional models (Zvolensky et al., 2006). However, cannabis users may have many different expectancy beliefs and motives about cannabis use, which may differentially influence patterns and maintenance of cannabis use. Indeed, the existing measures of expectancies (MEEQ) and motives (MMQ) consist of moderately inter-correlated subscales (MEEQ: *r*'s = .21 - .71; MMQ: *r*'s = .30 - .67). One recent study found that it was a combination of high positive and high negative expectancy beliefs for cannabis use were associated with greatest psychological distress (Conner et al., 2011). In contrast, the combination of low positive and high negative expectancies was associated with the lowest levels of psychological distress. It may be necessary to expand current conceptualizations of cannabis use behavior to include dimensional or "multi-motivational" models (Piper et al, 2004).

Limitations

There are several limitations of the current study. First, the current sample primarily consisted of older male Veterans. Therefore, it is unknown how the current findings would generalize to female Veterans or those who have served in a more recent era (e.g., IOF/EOF). Additionally, it is unknown to what extent the Veterans in the current sample were exposed to combat-related experiences, which would likely impact substance use and emotional distress symptoms differently than Peacetime service experiences. Second, because participants were recruited through a larger study on mental health and cannabis dependence (specifically, the role of PTSD in regard to quit behavior), it is possible that base rates of psychopathology (and PTSD specifically) may

be higher than among samples of cannabis dependent Veterans. This 'selection bias' naturally can influence the rates of variability observed in the sample and its global level of generalizability.

Third, it is possible that both cannabis and emotional distress symptoms were underreported (or distorted) due to perceived stigma among Veterans (Skidmore & Roy, 2011). Future work could therefore benefit by contextualizing the current results in the larger landscape of other self-quit behavior among civilian populations.

Fourth, emotional distress was measured as a time-invariant predictor of quit outcomes. Thus, we did not examine changes in distress indices as a function of changes in cannabis use trajectories. Future work could therefore address this limitation by modeling static and dynamic models of affect-based change in cannabis use and quit behavior.

Fifth, based on the assumption that substance dependence is more severe than abuse (DSM-IV-TR, 2000), the current study sampled only those Veterans meeting criteria for cannabis dependence. However, in the proposed revision of cannabis use disorders in the DSM-5, dependence and abuse will be collapsed into one "cannabis use" disorder (APA, 2012). This change is based on factor analytic research that has typically yielded a single-factor solution or two highly-correlated factors among cannabis using persons (Beseler & Hasin, 2010; Compton, Saba, Conway, & Grant, 2009; Teesson, Lynskey, Manor, & Baillie, 2002). In light of this impending diagnostic change, the current results should be interpreted cautiously in the future and replicated among cannabis abuse/dependence samples.

Finally, it is important to recall that the current study employed a 'self-guided quit attempt' method for cannabis cessation. Some scholars have questioned the validity of self-quit studies on numerous grounds (e.g., 'seriousness' of the quit attempt, motivational basis for quit attempt may differ compared to treatment; see discussion by Cohen et al., 1989). Thus, it would be useful to contextualize the current findings in relation to treatment-seeking quit behavior with psychosocial and/or pharmacological intervention.

Integrative Summary and Implications

The current findings add to the small body of literature on examining the impact of emotional distress on cannabis use processes, problems, and quit behavior in general and among military Veterans in particular. Although complex patterns of results emerged, the present findings can be used as a starting point to better understand emotional distress-cannabis dependence co-occurrence among Veterans and other 'high risk' populations, and inform research development in at least two ways.

First, the results of the present study can be contextualized in the context of integrated models of substance use-emotional distress co-occurrence. As seen in other substances of misuse, beliefs about the effects of cannabis and motivations for use likely play an important role in understanding the maintenance of cannabis use, especially among emotionally vulnerable individuals. Existing theoretical models could be expanded to consider the unique influences of depressive and panic symptoms on the development and maintenance of cannabis dependence. Furthermore, given the unique differences between different classes of substances, it is especially important for scholars to develop *cannabis-specific* models of cannabis-emotional distress in order to improve the specificity to which we understand the nature of cannabis use and dependence. The

findings here contribute a small amount to the emerging literature on emotion and cannabis, as examined among Veterans, and should be considered in formulating the next wave of theoretical model in this area.

Second, the present findings have potential implications for prevention or intervention development for cannabis dependent Veterans. Recently, an encouraging comprehensive assessment of the Mental Health Care System of the Veteran Health Administration found that treatment for substance use disorders (intensive outpatient treatment, psychosocial interventions) was available in more than 90% of treatment facilities, and more than 79% offering integrated dual-diagnosis therapy (Watkins et al., 2011; pg. 49). The majority of sampled Veterans with a substance use disorder received treatment through a brief intervention or specialty care clinic (71.3%), which given low rates of treatment engagement (13.5%), may indeed be the most efficient model of treatment (specifically, documented in the case of alcohol; Moyer, Finney, Swearingen, & Vergun, 2002). Data indicated that 46.5% of Veterans with a substance use disorder and co-morbid psychiatric disorder received treatment for both conditions within the same day, suggesting fairly well-coordinated (if not integrated) treatment (Watkins et al., 2011; pg. 77). While it is unclear the extent to which *cannabis use disorders* are represented in these data, these results are encouraging and suggest that it is likely feasible to further refine integrated treatment programs for Veterans. For example, providing psychoeducation about the influence of emotional distress on cannabis use, and personalized feedback/functional analysis of substance use patterns and emotional distress may aid in reduction of cannabis use, as similar feedback approaches have been found to be effective in reducing actual substance use (Larimer et al., 2007). Future study

is needed to (1) better understand how cannabis use disorders are treated in the VA, then (2) evaluate the efficacy/effectiveness of these interventions, and then (3) examine if/how existing treatments can be bolstered to address relevant affective vulnerabilities.

In sum, it appears that processes explicating the nature of the cannabis-emotional relationship are complex and interactional, whereby the *combination* of panic and depressive symptoms may be important to consider when conceptualizing the impact of negative reinforcement-based expectations and coping motives among Veterans. That said, the direction and patterning of these relations may vary substantively, and that panic symptoms, in particular, may be uniquely important when examining cannabis-quit behavior. Based upon these findings, a chief task for future work would be to develop more refined theoretical models of cannabis-affect relations among Veterans and civilian population to specify the time points and processes involved.

References

Aarons, G. A., Brown, S. A., Stice, E., & Coe, M. T. (2001). Psychometric evaluation of the Marijuana and Stimulant Effect Expectancy Questionnaires for adolescents. *Addictive Behaviors, 26*(2), 219-236. doi:10.1016/S0306-4603(00)00103-9

Agosti, V., & Levin, F. R. (2007). Predictors of cannabis dependence recovery among epidemiological survey respondents in the United States. *The American Journal of Drug and Alcohol Abuse, 33*(1), 81-88. doi:10.1080/00952990601087364

Agosti, V., Nunes, E., & Levin, F. (2002). Rates of psychiatric comorbidity among U.S. residents with lifetime cannabis dependence. *American Journal of Drug and Alcohol Abuse, 28*, 643-652. doi:10.1081/ADA-120015873

Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. Newbury Park, CA: Sage.

Allsop, S., Carter, O., & Lenton, S. (2010). Enhancing clinical research with alcohol, tobacco and cannabis problems and dependence. *Drug And Alcohol Review*, *29*(5), 483-490. doi:10.1111/j.1465-3362.2010.00171.x

American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders, Fourth Edition — Text Revision. American Psychiatric Press, Washington D.C.

American Psychiatric Association (2012). DSM-5 Development. R 08 Cannabis Use Disorder, proposed revision. Updated April 30, 2012. Accessed August 22, 2012; http://www.dsm5.org/ProposedRevision/Pages/proposedrevision.aspx?rid=454#

Amos, A., Wiltshire, S., Bostock, Y., Haw, S., & McNeill, A. (2004). 'You can't go without a fag ... you need it for your hash'--a qualitative exploration of smoking, cannabis and young people. *Addiction, 99*(1), 77-81. doi:10.1111/j.1360-0443.2004.00531.x

Anthony, J. C., Warner, L. A., & Kessler, R. C. (1994). Comparative epidemiology of dependence on tobacco, alcohol, controlled substances, and inhalants: Basic findings from the National Comorbidity Survey. *Experimental and Clinical Psychopharmacology, 2*(3), 244-268. doi:10.1037/1064-1297.2.3.244

Arendt, M., Rosenberg, R., Foldager, L., Perto, G., & Munk-Jørgensen, P. (2007). Psychopathology among cannabis-dependent treatment seekers and association with later substance abuse treatment. *Journal of Substance Abuse Treatment, 32*(2), 113-119. doi:10.1016/j.jsat.2006.07.005

Ashton, C. (2001). Pharmacology and effects of cannabis: A brief review. *The British Journal of Psychiatry, 178,* 101-106. doi:10.1192/bjp.178.2.101

Babson, K. A., Feldner, M. T., Sachs-Ericsson, N., Schmidt, N. B., & Zvolensky, M. J. (2008). Nicotine dependence mediates the relations between insomnia and both panic and posttraumatic stress disorder in the NCS-R sample. *Depression and Anxiety, 25*(8), 670-679. doi:10.1002/da.2037

Baker, T. B., Brandon, T. H., & Chassin, L. (2004). Motivational influences on cigarette smoking. *Annual Review of Psychology, 55*463-491. doi:10.1146/annurev.psych.55.090902.142054

Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore, M. C. (2004). Addiction motivation reformulated: An affective processing model of negative

reinforcement. *Psychological Review, 111*(1), 33-51. doi:10.1037/0033-295X.111.1.33

Beautrais, A. L., Joyce, P. R., & Mulder, R. T. (1999). Cannabis abuse and serious suicide attempts. *Addiction, 94*(8), 1155-1164. doi: 10.1046/j.1360-0443.1999.94811555.x

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck Depression Inventory manual (2nd ed.). San Antonio, TX: Psychological Corporation.

Beseler, C. L., & Hasin, D. S. (2010). Cannabis dimensionality: Dependence, abuse and consumption. *Addictive Behaviors,35*(11), 961-969. doi:10.1016/j.addbeh.2010.06.011

Blume, A. W. (2012). Seeking the middle way: G. Alan Marlatt and harm reduction. *Addiction Research & Theory, 20*(3), 218-226. doi:10.3109/16066359.2012.657281

Bonn-Miller, M. O., Boden, M., Vujanovic, A. A., & Drescher, K. D. (2012). Prospective investigation of the impact of cannabis use disorders on posttraumatic stress disorder symptoms among veterans in residential treatment. *Psychological Trauma: Theory, Research, Practice, and Policy, To Appear*. doi:10.1037/a0026621

Bonn-Miller, M. O., Harris, A. S., & Trafton, J. A. (2012). Prevalence of cannabis use disorder diagnoses among Veterans in 2002, 2008, and 2009. *Psychological Services, To Appear.* doi:10.1037/a0027622

Bonn-Miller, M. O., & Moos, R. H. (2009). Marijuana discontinuation, anxiety symptoms, and relapse to marijuana. *Addictive Behaviors*, *34*(9), 782-785. doi:10.1016/j.addbeh.2009.04.009

Bonn-Miller, M. O., Vujanovic, A. A., & Drescher, K. D. (2011). Cannabis use among military veterans after residential treatment for posttraumatic stress disorder. *Psychology of Addictive Behaviors, 25*(3), 485-491. doi:10.1037/a0021945

Bonn-Miller, M. O., Vujanovic, A. A., Feldner, M. T., Bernstein, A., & Zvolensky, M. J. (2007). Posttraumatic stress symptom severity predicts marijuana use coping motives among traumatic event-exposed marijuana users. *Journal of Traumatic Stress*, *20*(4), 577-586. doi:10.1002/jts.20243

Bonn-Miller, M. O., Vujanovic, A. A., & Zvolensky, M. J. (2008). Emotional dysregulation: Association with coping-oriented marijuana use motives among current marijuana users. *Substance Use & Misuse*, *43*(11), 1653-1665. doi:10.1080/10826080802241292

Bonn-Miller, M. O., & Zvolensky, M. J. (2009). Marijuana use, abuse, and dependence: Evaluation of panic responsivity to biological challenge. *Journal of Psychoactive Drugs, 41*(4), 331-336.

Bonn-Miller, M. O., Zvolensky, M. J., & Bernstein, A. (2007). Marijuana use motives: Concurrent relations to frequency of past 30-day use and anxiety sensitivity among young adults marijuana smokers. *Addictive Behaviors, 32*, 49-62. doi:10.1016/j.addbeh.2006.03.018

Bovasso, G. B. (2001). Cannabis abuse as a risk factor for depressive symptoms. *The American Journal of Psychiatry*, *158*(12), 2033-2037. doi:10.1176/appi.ajp.158.12.2033

Brandon, T. H., & Baker, T. B. (1991). The smoking consequences questionnaires: The subjective utility of smoking in college students. *Psychological Assessment, 3,* 484-491. doi:10.1037//1040-3590.3.3.484

Brook, J. S., Cohen, P., & Brook, D. W. (1998). Longitudinal study of co-occurring psychiatric disorders and substance use. *Journal of The American Academy of Child & Adolescent Psychiatry*, *37*(3), 322-330. doi:10.1097/00004583-199803000-00018

Brown, S. A. (1985). Reinforcement expectancies and alcoholism treatment outcome after a one-year follow-up. *Journal of Studies on Alcohol*, *46*(4), 304-308.

Brown, S. A., Goldman, M. S., Inn, A., & Anderson, L. R. (1980). Expectations of reinforcement from alcohol: Their domain and relation to drinking patterns. *Journal of Consulting and Clinical Psychology*, *48*(4), 419-426. doi:10.1037/0022-006X.48.4.419

Brown, T. A., & Barlow, D. H. (2009). A proposal for a dimensional classification system based on the shared features of the DSM-IV anxiety and mood disorders: Implications for assessment and treatment. *Psychological Assessment*, *21*(3), 256-271. doi:10.1037/a0016608

Buckner, J. D., Bonn-Miller, M. O., Zvolensky, M. J., & Schmidt, N. B. (2007). Marijuana use motives and social anxiety among marijuana-using young adults. *Addictive Behaviors*, *32*(10), 2238-2252. doi:10.1016/j.addbeh.2007.0

4.004

Buckner, J. D., & Carroll, K. M. (2010). Effect of anxiety on treatment presentation and outcome: Results from the Marijuana Treatment Project. *Psychiatry Research*, *178*(3), 493-500. doi:10.1016/j.psychres.2009.10.010

Buckner, J. D., Joiner, T. E., Schmidt, N. B., & Zvolensky, M. J. (2012). Daily marijuana use and suicidality: The unique impact of social anxiety. *Addictive Behaviors, 37,* 387-392. doi: 10.1016/j.addbeh.2011.11.019

Buckner, J. D., & Schmidt, N. B. (2008). Marijuana effect expectancies: Relations to social anxiety and marijuana use problems. *Addictive Behaviors, 33,* 1477–1483. doi:10.1016/j.addbeh.2008.06.017

Buckner, J. D., & Schmidt, N. B. (2009). Social anxiety disorder and marijuana use problems: The mediating role of marijuana effect expectancies. *Depression and Anxiety, 26,* 864-870. doi:10.1002/da.20567

Buckner, J. D., Zvolensky, M. J., & Schmidt, N.B. (2012). Cannabis-related impairment and social anxiety: The roles of gender and cannabis use motives. *Addictive Behaviors. To Appear.* doi:10.1016/j.addbeh.2012.06.013

Buckner, J. D., Zvolensky, M. J., Smits, J., Norton, P. J., Crosby, R. D., Wonderlich, S. A., & Schmidt, N. B. (2011). Anxiety sensitivity and marijuana use: An analysis from ecological momentary assessment. *Depression and Anxiety, 28,* 412-419. doi:10.1002/da.20816

Budney, A. J., & Hughes, J. R. (2006). The cannabis withdrawal syndrome. *Current Opinion in Psychiatry 19,* 233–238. doi:10.1097/01.yco.0000218592.00689.e5

Budney, A. J., Hughes, J. R., Moore, B. A., & Vandrey, R. (2004). Review of the validity and significance of cannabis withdrawal syndrome. *American Journal of Psychiatry 161*,1967–1977. doi:10.1176/appi.ajp.161.11.1967

Budney, A. J., Moore, B. A., Rocha, H. L., & Higgins, S. T. (2006). Clinical trial of abstinence-based vouchers and cognitive-behavioral therapy for cannabis dependence. *Journal of Consulting and Clinical Psychology, 74*(2), 307-316. doi:10.1037/0022-006X.74.2.307

Carey, K. B. (1997). Reliability and validity of the time-line follow-back interview among psychiatric outpatients: A preliminary report. *Psychology of Addictive Behaviors, 11*(1), 26-33. doi:10.1037/0893-164X.11.1.26

Chabrol, H., Ducongé, E., Casas, C., Roura, C., & Carey, K. B. (2005). Relations between cannabis use and dependence, motives for cannabis use and anxious, depressive and borderline symptomatology. *Addictive Behaviors, 30*(4), 829-840. doi:10.1016/j.addbeh.2004.08.027

Chen, C., Wagner, F. A., & Anthony, J. C. (2002). Marijuana use and the risk of major depressive episode: Epidemiological evidence from the United States National Comorbidity Survey. *Social Psychiatry and Psychiatric Epidemiology, 37*(5), 199-206. doi:10.1007/s00127-002-0541-z

Christiansen, B. A., Smith, G. T., Roehling, P. V., & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology, 57*(1), 93-99. doi:10.1037/0022-006X.57.1.93

Chung, T., Martin, C. S., Cornelius, J. R., Clark, D. B. (2008). Cannabis withdrawal predicts severity of cannabis involvement at 1-year follow-up among treated adolescents. *Addiction 103*, 787–799. doi:10.1111/j.1360-0443.2008.02158.x

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100*(3), 316-336. doi:10.1037/0021-843X.100.3.316

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/ correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, J., Cohen, P., West, S. G., Aiken, L. S. (2003). Applied Multiple Regression/ Correlational Analysis for the Behavioral Sciences (3rd ed.); Mahwah, NJ: Erlbaum.

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment, 6*(2), 117-128. doi:10.1037/1040-3590.6.2.117

Cohen, S., Lichtenstein, E., Prochaska, J. O., Rossi, J. S., Gritz, E. R., Carr, C. R., & ... Ossip-Klein, D. (1989). Debunking myths about self-quitting: Evidence from 10 prospective studies of persons who attempt to quit smoking by themselves. *American Psychologist*, *44*(11), 1355-1365. doi:10.1037/0003-066X.44.11.1355

Cooper, M., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology, 69*(5), 990-1005. doi:10.1037/0022-3514.69.5.990

Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety sensitivity and sensation seeking to adolescents' motivations for alcohol, cigarette and marijuana use. *Addictive Behaviors*,*26*(6), 803-825. doi:10.1016/S0306-4603(01)00238-6

Compton, W. M., Grant, B. F., Colliver, J. D., Glantz, M. D., & Stinson, F. S. (2004). Prevalence of marijuana use disorders in the United States: 1991-1992 and 2001-2002. *Journal of the American Medical Association, 291*(17), 2114-2121. doi:10.1001/jama.291.17.2114

Compton, W. M., Saha, T. D., Conway, K. P., & Grant, B. F. (2009). The role of cannabis use within a dimensional approach to cannabis use disorders. *Drug and Alcohol Dependence, 100*(3), 221-227. doi:10.1016/j.drugalcdep.2008.10.009

Compton, M. T., Simmons, C. M., Weiss, P. S., & West, J. C. (2011). Axis IV psychosocial problems among patients with psychotic or mood disorders with a cannabis use disorder comorbidity. *The American Journal on Addictions*, *20*(6), 563-567. doi:10.1111/j.1521-0391.2011.00184.x

Conner, J. P., Gullo, M. J., Feeney, G. F. X., & Young, R. D. (2011). Validation of the Cannabis Expectancy Questionnaire (CEQ) in adult cannabis users in treatment. *Alcohol and Drug Dependence, 115*, 167-174. doi:10.1016/j.drugalcdep.2010.10.025

Copeland, A. L., Brandon, T. H., & Quinn, E. P. (1995). The Smoking Consequences Questionnaire-Adult: Measurement of smoking outcome expectancies of experienced smokers. *Psychological Assessment, 7*(4), 484-494. doi:10.1037/1040-3590.7.4.484

Copeland, J., & Swift, W. (2009). Cannabis use disorder: Epidemiology and management. *International Review of Psychiatry, 21*(2), 96-103. doi:10.1080/09540260902782745

Cornelius, J. R., Chung, T., Martin, C., Wood, D., & Clark, D. B. (2008). Cannabis withdrawal is common among treatment-seeking adolescents with cannabis dependence and major depression, and is associated with rapid relapse to dependence. *Addictive Behaviors*, *33*(11), 1500-1505. doi:10.1016/j.addbeh. 2008.02.001

Cougle, J. R., Bonn-Miller, M. O., Vujanovic, A. A., Zvolensky, M. J., & Hawkins, K. A. (2011). Posttraumatic stress disorder and cannabis use in a nationally representative sample. *Psychology of Addictive Behaviors, 25*(3), 554-558. doi:10.1037/a0023076

Cox, D. R. (1972). Regression Models and Life Tables (with Discussion). *Journal of the Royal Statistical Society, Series B*(34), 187—220.

Cox, W., & Klinger, E. (1988). Enhancing alcohol-dependent veterans' motivation to recover. *Psychology of Addictive Behaviors*, *2*(2), 53-58. doi:10.1037/h0080520

Crippa, J. S., Derenusson, G. N., Chagas, M. N., Atakan, Z., Martín-Santos, R., Zuardi, A. W., & Hallak, J. C. (2012). Pharmacological interventions in the treatment of the acute effects of cannabis: A systematic review of literature. *Harm Reduction Journal, 9, 1-6.* doi:10.1186/1477-7517-9-7

de Dios, M. A., Vaughan, E. L., Stanton, C. A., & Niaura, R. (2009). Adolescent tobacco use and substance abuse treatment outcomes. *Journal of Substance Abuse Treatment, 37*(1), 17–24. doi:10.1016/j.jsat.2008.09.006.

Degenhardt, L., & Hall, W. (2012). Extent of illicit drug use and dependence, and their contribution to the global burden of disease. *The Lancet, 379*(9810), 55-70. doi:10.1016/S0140-6736(11)61138-0

Edens, E. L., Kasprow, W., Tsai, J., & Rosenheck, R. A. (2011). Association of substance use and VA service- connected disability benefits with risk of homelessness among veterans. *The American Journal On Addictions, 20*(5), 412-419. doi:10.1111/j.1521-0391.2011.00166.x

Farchione, T. J., Fairholme, C. P., Ellard, K. K., Boisseau, C. L., Thompson-Hollands, J., Carl, J. R., & ... Barlow, D. H. (2012). Unified protocol for transdiagnostic treatment of emotional disorders: A randomized controlled trial. *Behavior Therapy*, *43*(3), 666-678. doi:10.1016/j.beth.2012.01.001

Feldner, M. T., Zvolensky, M. J., Schmidt, N. B., & Smith, R. C. (2008). A prospective test of anxiety sensitivity as a moderator of the relation between gender and posttraumatic symptom maintenance among high anxiety sensitive young adults. *Depression and Anxiety*, *25*(3), 190-199. doi:10.1002/da.20281

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). Structured Clinical Interview for DSM–IV Axis I Disorders (SCID-I). Washington, DC: American Psychiatric Press.

Flynn, P. M., & Brown, B. S. (2008). Co-occurring disorders in substance abuse treatment: Issues and prospects. *Journal of Substance Abuse Treatment*, *34*(1), 36-47. doi:10.1016/j.jsat.2006.11.013

Galen, L. W., & Henderson, M. J. (1999). Validation of cocaine and marijuana effect expectancies in a treatment setting. *Addictive Behaviors, 24*(5), 719-724. doi:10.1016/S0306-4603(98)00110-5

Goldman, M., Suh, J. J., Lynch, K. G., Szucs, R., Ross, J., Xie, H., & ... Oslin, D. W. (2010). Identifying risk factors for marijuana use among veterans affairs patients. *Journal of Addiction Medicine, 4*(1), 47-51. doi:10.1097/ADM.0b013e3181b18782.

Gorelick, D. A., Levin, K. H., Copersino, M. L., Heishman, S. J., Liu, F., Boggs, D. L., & Kelly, D. L. (2012). Diagnostic criteria for cannabis withdrawal syndrome. *Drug and Alcohol Dependence, 123*(1-3), 141-147. doi:10.1016/j.drugalcdep.2011.11.007.

Grant, B. F. (1995). Comorbidity between DSM-IV drug use disorders and major depression: Results of a national survey of adults. *Journal of Substance Abuse, 7*(4), 481-497. doi:10.1016/0899-3289(95)90017-9

Hall, S. M., Delucchi, K. L., Velicer, W. F., Kahler, C. W., Ranger-Moore, J., Hedeker, D.,... Niaura, R. (2001). Statistical analysis of randomized trials in tobacco treatment: longitudinal designs with dichotomous outcome. *Nicotine & Tobacco Research, 3,* 193-202. doi:10.1080/14622200110050411

Harrison, P. A., & Asche, S. E. (2001). Outcomes monitoring in Minnesota: Treatment implications, practical limitations. *Journal of Substance Abuse Treatment, 21*(4), 173-183. doi:10.1016/S0740-5472(01)00199-4

Hart, C. L., van Gorp, W., Haney, M., Foltin, R. W., & Fischman, M. W. (2001). Effects of acute smoked marijuana on complex cognitive performance. *Neuropsychopharmacology, 25*(5), 757-65. doi:10.1016/S0893-133X(01)00273-1

Hathaway, A. D. (2003). Cannabis effects and dependency concerns in long term frequent users: A missing piece of the public health puzzle. *Addiction Research and Theory, 11*, 441–458. doi:10.1080/1606635021000041807

Hayaki, J., Hagerty, C. E., Herman, D. S., de Dios, M. A., Anderson, B. J., & Stein, M. D. (2010). Expectancies and marijuana use frequency and severity among young females. *Addictive Behaviors, 35*(11), 995-1000. doi:10.1016/j.addbeh.2010.06.017

Hayward, C., Killen, J. D., Kraemer, H. C., & Taylor, C. (2000). Predictors of panic attacks in adolescents. *Journal of The American Academy of Child & Adolescent Psychiatry, 39*(2), 207-214. doi:10.1097/00004583-200002000-00021

Herkenham, M. (1995). *Localization of cannabinoid receptors in brain and periphery.* In Cannabinoid Receptors (ed. R. Pertewee), pp. 145-166. London: Academic Press.

Highet, G. G. (2004). The role of cannabis in supporting young people's cigarette smoking: A qualitative exploration. *Health Education Research,19*(6), 635-643. doi:10.1093/her/cyg089

Hoge, C. W., Auchterlonie, J. L., & Milliken, C. S. (2006). Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *Journal of the American Medical Association, 295*, 1023–1032. doi:10.1001/jama.295.9.1023

Hoge, C. W., Castro, C. A., Messer, S. C., McGurk, D., Cotting, D. I., & Koffman, R. L. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine, 351,* 13–22. doi:10.1056/NEJMoa040603

Holmbeck, G. N. (2002). Post-hoc probing of significant moderational and meditational effects in studies of pediatric populations. *Journal of Pediatric Psychology, 27,* 87-96.

Ikard, F. F., Green, D. E., & Horn, D. (1969). A scale to differentiate between types of smoking as related to the management of affect. *The International Journal oo the Addictions, 4,* 649-659. doi:10.3109/10826086909062040

Ilgen, M. A., Bohnert, A. S. B., Ignacio, R., McCarthy, J., Valenstein, M., Kim, H. M., & Blow, F. (2010). Psychiatric diagnoses and risk of suicide in veterans. *Archives of General Psychiatry, 67,* 1152–1158. doi: 10.1001/archgenpsychiatry.2010.129

Ilgen, M. A., McCarthy, J. F., Ignacio, R. V., Bohnert, A. B., Valenstein, M., Blow, F. C., & Katz, I. R. (2012). Psychopathology, Iraq and Afghanistan service, and suicide among Veterans Health Administration patients. *Journal of Consulting and Clinical Psychology*, *80*(3), 323-330. doi:10.1037/a0028266

Johns, A. (2001). Psychiatric effects of cannabis. *The British Journal of Psychiatry, 178,* 116-122. doi:10.1192/bjp.178.2.116

Johnson, K. A., Farris, S. G., Schmidt, N. B., Smits, J. A. J., & Zvolensky, M. J. (2012). Panic attack history and anxiety sensitivity in relation to cognitive-based smoking processes among treatment-seeking daily smokers. *Nicotine & Tobacco Research. To appear.*

Jones, B. T., Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction, 96*(1), 57-72. doi:10.1046/j.1360-0443.2001.961575.x

Institute of Medicine. (2006). *Improving the quality of health care for mental and substance-use conditions: Quality Chasm Series*. Washington, DC: The National Academies Press.

Kadden, R. M., Litt, M. D., Kabela-Cormier, E., & Petry, N. M. (2007). Abstinence rates following behavioral treatments for marijuana dependence. *Addictive Behaviors, 32*(6), 1220-1236. doi:10.1016/j.addbeh.2006.08.009

Kandel, D., Chen, K., Warner, L.A., Kessler, R.C., & Grant, B. (1997). Prevalence and demographic correlates of symptoms of dependence on cigarettes, alcohol, marijuana, and cocaine in the U.S. population. *Drug and Alcohol Dependence, 44*, 437-442.10.1016/S0376-8716(96)01315-4

Kang, H. K., & Bullman, T. (2008). Risk of suicide among US veterans after returning from the Iraq or Afghanistan war zones. *Journal of the American Medical Association, 300*, 652–653. doi:10.1001/jama.300.6.652

Katz, E. C., Fromme, K., & D'Amico, E. J. (2000). Effects of outcome expectancies and personality on young adults' illicit drug use, heavy drinking, and risky sexual behavior. *Cognitive Therapy and Research*,*24*(1), 1-22.

Kessler, R. C., Chiu, W., Demler, O., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-Month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 617-627. doi:10.1001/archpsyc.62.6.617

Kessler, R. C., Crum, R. M., Warner, L. A., Nelson, C. B., Schulenberg, J., &Anthony, J. C. (1997). Lifetime co-occurrence of DSM III-R alcohol abuse and dependence with other psychiatric disorders in the National Comorbidity Survey. *Archives of General Psychiatry, 54*, 313–321. doi:10.1001/archpsyc.1997.01830160031005

Kessler, R. C., Sonnega, A., Bromet, E., & Hughes, M. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, *52*(12), 1048-1060. doi:10.1001/archpsyc.1995.03950240066012

Krishnamoorthy, K. , Mallick, A. & Mathew, T. (2009). Model based imputation approach for data analysis in the presence of non-detects. *Annals of Occupational Hygiene, 59*, 249-268. doi:10.1093/annhyg/men083

Kristjansson, S. D., Agrawal, A., Lynskey, M. T., & Chassin, L. A. (2012). Marijuana expectancies and relationships with adolescent and adult marijuana use. *Drug and Alcohol Dependence*, To appear. doi:10.1016/j.drugalcdep.2012.04.024

Larimer, M. E., Lee, C. M., Kilmer, J. R., Fabiano, P. M., Stark, C. B., Geisner, I. M., & ... Neighbors, C. (2007). Personalized mailed feedback for college drinking prevention: A randomized clinical trial. *Journal of Consulting and Clinical Psychology, 75*(2), 285-293. doi:10.1037/0022-006X.75.2.285

Latimer, W. W., Winters, K. C., Stinchfield, R., & Traver, R. E. (2000). Demographic, individual, and interpersonal predictors of adolescent alcohol and marijuana use following treatment. *Psychology of Addictive Behaviors, 14*(2), 162-173. doi:10.1037/0893-164X.14.2.162

Leventhal, A. M., Zvolensky, M. J., & Schmidt, N. B. (2011). Smoking-related correlates of depressive symptom dimensions in treatment-seeking smokers. *Nicotine & Tobacco Research, 13*, 668-676. doi:10.1093/ntr/ntr056

Lev-Ran, S., Imtiaz, S., Taylor, B. J., Shield, K. D., Rehm, J., & Le Foll, B. (2012). Gender differences in health-related quality of life among cannabis users: Results from the national epidemiologic survey on alcohol and related conditions. *Drug and Alcohol Dependence, 123*(1-3), 190-200. doi:10.1016/j.drugalcdep.2011.11.010

Lobbestael, J., Leurgans, M., & Arntz, A. (2011). Inter- rater reliability of the Structured Clinical Interview for DSM- IV Axis I disorders (SCID I) and Axis II disorders (SCID II). *Clinical Psychology & Psychotherapy*, *18*(1), 75-79. doi:10.1002/cpp.693

Lopez-Quintero, C., de los Cobos, J., Hasin, D. S., Okuda, M., Wang, S., Grant, B. F., & Blanco, C. (2011). Probability and predictors of transition from first use to dependence on nicotine, alcohol, cannabis, and cocaine: Results of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Drug and Alcohol Dependence*, *115*(1-2), 120-130. doi:10.1016/j.drugalcdep.2010.11.004

Li, W., & Zinbarg, R. E. (2007). Anxiety sensitivity and panic attacks: A 1-year longitudinal study. *Behavior Modification*, *31*(2), 145-161. doi:10.1177/0145445506296969

Lynskey, M. T., Glowinski, A. L., Todorov, A. A., Bucholz, K. K., Madden, P. F., Nelson, E. C., & ... Heath, A. C. (2004). Major depressive disorder, suicidal ideation, and suicide attempt in twins discordant for cannabis dependence and

early-onset cannabis use. *Archives of General Psychiatry*, *61*(10), 1026-1032. doi:10.1001/archpsyc.61.10.1026

Lynskey, M., & Hall, W. (2000). The effects of adolescent cannabis use on educational attainment: A review. *Addiction, 95*(11), 1621-1630. doi:10.1046/j.1360-0443.2000.951116213.x

Magruder, K. M., & Yeager, D. E. (2009). The prevalence of PTSD across war eras and the effect of deployment on PTSD: A systematic review and meta-analysis. *Psychiatric Annals*, *39*(8), 778-788. doi:10.3928/00485713-20090728-04

Maisto, S. A., Sobell, L. C., Cooper, A., & Sobell, M. B. (1982). Comparison of two techniques to obtain retrospective reports of drinking behavior from alcohol abusers. *Addictive Behaviors*, *7*(1), 33-38. doi:10.1016/0306-4603(82)90022-3

Maller, R. G., & Reiss, S. (1992). Anxiety sensitivity in 1984 and panic attacks in 1987. *Journal of Anxiety Disorders*, *6*, 241–247. doi:10.1016/0887-6185(92)90036-7

Marijuana Treatment Project Research Group (2004). Brief treatments for cannabis dependence: Findings from a randomized multisite trial. *Journal of Consulting and Clinical Psychology*, *72*(3), 455-466. doi:10.1037/0022-006X.72.3.455

Martens, K. M., & Gilbert, D. G. (2008). Marijuana and tobacco exposure predict affect-regulation expectancies in dual users. *Addictive Behaviors*, *33*(11), 1484-1490. doi:10.1016/j.addbeh.2008.07.002

McManus, F., Shafran, R., & Cooper, Z. (2010). What does a 'transdiagnostic' approach have to offer the treatment of anxiety disorders? *British Journal of Clinical Psychology*, *49*(4), 491-505. doi:10.1348/014466509X476567

Metrik, J., Kahler, C. W., McGeary, J. E., Monti, P. M., & Rohsenow, D. J. (2011). Acute effects of marijuana smoking on negative and positive affect. *Journal of Cognitive Psychotherapy,* 25(1), 31-46. doi:10.1891/0889-8391.25.1.31

Milliken, C. S., Auchterlonie, J. L., & Hoge, C. W. (2007). Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. *Journal of The American Medical Association, 298*(18), 2141-2148. doi:10.1001/jama.298.18.2141

Mineka, S., Watson, D., & Clark, L. (1998). Comorbidity of anxiety and unipolar mood disorders. *Annual Review of Psychology, 49*377-412. doi:10.1146/annurev.psych.49.1.377

Mitchell, H., Zvolensky, M. J., Marshall, E. C., Bonn-Miller, M. O., & Vujanovic, A. A. (2007). Incremental validity of coping-oriented marijuana use motives in the prediction of affect-based psychological vulnerability. *Journal of Psychopathology and Behavioral Assessment*,*29*(4), 277-288. doi:10.1007/s10862-007-9047-z

McNally, R. J. (2002). Anxiety sensitivity and panic disorder. *Biological Psychiatry, 52*, 938-946. doi:10.1016/S0006-3223(02)01475-0

Moore, B. A., & Budney, A. J. (2003). Relapse in outpatient treatment for marijuana dependence. *Journal of Substance Abuse Treatment, 25*(2), 85-89. doi:10.1016/S0740-5472(03)00083-7

Moyer, A., Finney, J. W., Swearingen, C. E., & Vergun, P. (2002). Brief interventions for alcohol problems: A meta-analytic review of controlled investigations in

treatment-seeking and non-treatment-seeking populations. *Addiction*, *97*(3), 279-292. doi:10.1046/j.1360-0443.2002.00018.x

Nazarian, D., Kimerling, R., & Frayne, S. M. (2012). Posttraumatic stress disorder, substance use disorders, and medical comorbidity among returning U.S. veterans. *Journal of Traumatic Stress*, *25*(2), 220-225. doi:10.1002/jts.21690

Norberg, M. M., Mackenzie, J., & Copeland, J. (2012). Quantifying cannabis use with the Timeline Followback approach: A psychometric evaluation. *Drug and Alcohol Dependence, 121*(3), 247-252. doi:10.1016/j.drugalcdep.2011.09.007

Patton, G. C., Coffey, C., Carlin, J. B., Sawyer, S. M., & Lynskey, M. (2005). Reverse gateways? Frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. *Addiction*, *100*(10), 1518-1525. doi:10.1111/j.1360-0443.2005.01220.x

Peters, E. N., Nich, C., & Carroll, K. M. (2011). Primary outcomes in two randomized controlled trials of treatments for cannabis use disorders. *Drug and Alcohol Dependence*, *118*(2-3), 408-416. doi:10.1016/j.drugalcdep.2011.04.021

Piper, M. E., Piasecki, T. M., Federman, E., Bolt, D. M., Smith, S. S., Fiore, M. C., & Baker, T. B. (2004). A multiple motives approach to tobacco dependence: The Wisconsin Inventory of Smoking Dependence Motives (WISDM-68). *Journal of Consulting and Clinical Psychology*,*72*(2), 139-154. doi:10.1037/0022-006X.72.2.139

Ramo, D. E., Liu, H., & Prochaska, J. J. (2012). Tobacco and marijuana use among adolescents and young adults: A systematic review of their co-use. Clinical Psychology Review, 32, 105-121. doi:10.1016/j.cpr.2011.12.002

Ritter, C., Clayton, R. R., & Voss, H. L. (1985). Vietnam military service and marijuana use. *The American Journal of Drug and Alcohol Abuse,11*(1-2), 119-130. doi:10.3109/00952998509016854

Russell, M.A.H ., Peto,1 . & Patel, U.A. (1974) The classification of smoking by factorial structure of motives. *Journal of the Royal Statistical Society,137,* 313•333.

Schafer, J., & Brown, S. A. (1991). Marijuana and cocaine effect expectancies and drug use patterns. *Journal of Consulting and Clinical Psychology, 59*(4), 558-565. doi:10.1037/0022-006X.59.4.558

Schmidt, N. B., Lerew, D. R., & Jackson, R. J. (1997). The role of anxiety sensitivity in the pathogenesis of panic: Prospective evaluation of spontaneous panic attacks during acute stress. *Journal of Abnormal Psychology, 106*(3), 355-364. doi:10.1037/0021-843X.106.3.355

Schmidt, N. B., Lerew, D. R., & Jackson, R. J. (1999). Prospective evaluation of anxiety sensitivity in the pathogenesis of panic: Replication and extension. *Journal of Abnormal Psychology, 108,* 532–537. doi:10.1037//0021-843X.108.3.532

Schmidt, N. B., Zvolensky, M. J., & Maner, J. K. (2006). Anxiety sensitivity: Prospective prediction of panic attacks and Axis I pathology. *Journal of Psychiatric Research, 40*(8), 691-699. doi:10.1016/j.jpsychires.2006.07.009

Seal, K. H., Cohen, G., Waldrop, A., Cohen, B. E., Maguen, S., & Ren, L. (2011). Substance use disorders in Iraq and Afghanistan veterans in VA healthcare, 2001–2010: Implications for screening, diagnosis and treatment. *Drug and Alcohol Dependence, 116*(1-3), 93-101. doi:10.1016/j.drugalcdep.2010.11.027

Secora, A. M., Eddie, D., Wyman, B. J., Brooks, D. J., Mariani, J. J., & Levin, F. R. (2010). A comparison of psychosocial and cognitive functioning between depressed and non-depressed patients with cannabis dependence. *Journal Of Addictive Diseases*, *29*(3), 325-337. doi:10.1080/10550887.2010.489444

Shear, M., Greeno, C., Kang, J., Ludewig, D., Frank, E., Swartz, H. A., & Hanekamp, M. (2000). Diagnosis of nonpsychotic patients in community clinics. *The American Journal of Psychiatry*, *157*(4), 581-587.

Simons, J. S., & Arens, A. M. (2007). Moderating effects of sensitivity to punishment and sensitivity to reward on associations between marijuana effect expectancies and use. *Psychology of Addictive Behaviors*, *21*(3), 409-414. doi:10.1037/0893-164X.21.3.409

Simons, J., Correia, C. J., & Carey, K. B. (2000). A comparison of motives for marijuana and alcohol use among experienced users. *Addictive Behaviors*, *25*(1), 153-160. doi:10.1016/S0306-4603(98)00104-X

Simons, J., Correia, C. J., Carey, K. B., & Borsari, B. E. (1998). Validating a five-factor marijuana motives measure: Relations with use, problems, and alcohol motives. *Journal of Counseling Psychology*, *45*(3), 265-273. doi:10.1037/0022-0167.45.3.265

Simons, J. S., Gaher, R. M., Correia, C. J., Hansen, C. L., & Christopher, M. S. (2005). An affective-motivational model of marijuana and alcohol problems among college students. *Psychology of Addictive Behaviors*,*19*(3), 326-334. doi:10.1037/0893-164X.19.3.326

Simpson, T. L., Moore, S. A., Luterek, J., Varra, A. A., Hyerle, L., Bush, K., & ... Kivlahan, D. R. (2012). Psychiatric correlates of medical care costs among veterans receiving mental health care. *Journal of Interpersonal Violence, 27*(6), 1005-1022. doi:10.1177/0886260511424496

Skidmore, W., & Roy, M. (2011). Practical considerations for addressing substance use disorders in veterans and service members. *Social Work in Health Care*, *50*(1), 85-107. doi:10.1080/00981389.2010.522913

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back: A technique for assessing self-reported alcohol consumption. In R. Z. Litten, J. P. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biochemical methods* (pp. 41-72). Totowa, NJ US: Humana Press.

Solowij, N., & Pesa, N. (2010). Cognitive abnormalities and cannabis use. *Revista Brasileria de Psiquiatria, 32*(Suppl 1), S21-S40.

Stephens, R. S. (1999). Cannabis and hallucinogens. In B. S. McCrady, E. E. Epstein (Eds.), *Addictions: A comprehensive guidebook* (pp. 121-140). New York, NY US: Oxford University Press.

Stephens, R. S., Roffman, R. A., & Curtin, L. (2000). Comparison of extended versus brief treatments for marijuana use. *Journal of Consulting and Clinical Psychology, 68*, 898-908. doi:10.1037//0022-006X.68.5.898

Stewart, S. H., Zeitlin, S. B., & Samoluk, S. (1996). Examination of a three-dimensional drinking motives questionnaire in a young adult university student sample. *Behaviour Research and Therapy*, *34*(1), 61-71. doi:10.1016/0005-7967(95)00036-W

Stewart, S. H., Zvolensky, M. J., & Eifert, G. H. (2001). Negative-reinforcement drinking motives mediate the relation between anxiety sensitivity and increased drinking behavior. *Personality and Individual Differences, 31*(2), 157-171. doi:10.1016/S0191-8869(00)00213-0

Stinson, F. S., Ruan, W. J., Pickering, R., & Grant, B.F. (2006). Cannabis use disorders in the USA: prevalence, correlates and co-morbidity. *Psychological Medicine, 36*, 1447-1460 doi:10.1017/S0033291706008361

Substance Abuse and Mental Health Services Administration (2011). Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-41, HHS Publication No. (SMA) 11-4658. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2011.

Tanda, G., & Goldberg, S. R. (2003). Cannabinoids: Reward, dependence, and underlying neurochemical mechanisms – a review of recent preclinical data. *Psychopharmacology, 169*, 115–134. doi:10.1007/s00213-003-1485-z

Tanda, G., Pontieri, F. E., & Di Chiara, G. (1997). Cannabinoid and heroin activation of mesolimbic dopamine transmission by a common opioid receptor mechanism. *Science, 276*, 2048-2059. doi:10.1126/science.276.5321.2048

Taylor, S. (1999). *Anxiety sensitivity: Theory, research, and treatment of the fear of anxiety*. Mahwah, NJ US: Lawrence Erlbaum Associates Publishers.

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R.,... Cardenas, S. J. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment, 19*(2), 176-188. doi: 10.1037/1040-3590.19.2.176

Teesson, M., Lynskey, M., Manor, B., & Baillie, A. (2002). The structure of cannabis dependence in the community. *Drug and Alcohol Dependence*, *68*(3), 255-262. doi:10.1016/S0376-8716(02)00223-5

Thomas, H. (1996). A community survey of adverse effects of cannabis use. *Drug and Alcohol Dependence*, *42*(3), 201-207. doi:10.1016/S0376-8716(96)01277-X

Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behavior: Role of automatic and nonautomatic processes. *Psychological Review*, *97*(2), 147-168. doi:10.1037/0033-295X.97.2.147

Tournier, M., Sorbara, F., Gindre, C., Swendsen, J. D., & Verdoux, H. (2003). Cannabis use and anxiety in daily life: A naturalistic investigation in a non-clinical population. *Psychiatry Research*, *118*(1), 1-8. doi:10.1016/S0165-1781(03)00052-0

Van Dam, N. T., Bedi, G., & Earleywine, M. (2012). Characteristics of clinically anxious versus non-anxious regular, heavy marijuana users. *Addictive Behaviors*, To appear. doi:10.1016/j.addbeh.2012.05.021

Wagner, T. H., Harris, K. M., Federman, B., Dai, L., Luna, Y., & Humphreys, K. (2007). Prevalence of substance use disorders among veterans and comparable nonveterans from the National Survey on Drug Use and Health. *Psychological Services*, *4*(3), 149-157. doi:10.1037/1541-1559.4.3.149

Watson, D. (2000). *Mood and temperament.* New York: Guilford Press.

Watson, D., O'Hara, M. W., Simms, L. J., Kotov, R., Chmielewski, M., McDade-Montez, E., . . . Stuart, S. (2007). Development and validation of the Inventory of

Depression and Anxiety Symptoms (IDAS). *Psychological Assessment, 19*, 253–268. doi:10.1037/1040-3590.19.3.253

Watkins, K. E., Hunter, S. B., Burnam, M., Pincus, H., & Nicholson, G. (2005). Review of treatment recommendations for persons with a co-occurring affective or anxiety and substance use disorder. *Psychiatric Services*, *56*(8), 913-926. doi:10.1176/appi.ps.56.8.913

Watkins, K. E., Smith, B., Mannle, T. E., Woodroffe, A., Solomon, J., Sorbero, M.,... & Pincus, H. A. (2011). Program evaluation of Veterans Health Administration mental health services: Capstone report. U.S. Department of Veterans Affairs: RAND Corporation, Santa Monica, CA.

Wetter, D. W., Smith, S. S., Kenford, S. L., Jorenby, D. E., Fiore, M. C., Hurt, R. D., & ... Baker, T. B. (1994). Smoking outcome expectancies: Factor structure, predictive validity, and discriminant validity. *Journal of Abnormal Psychology,103*(4), 801-811. doi:10.1037/0021-843X.103.4.801

Ziedonis, D., Hitsman, B., Beckham, J. C., Zvolensky, M., Adler, L. E., Audrain-McGovern, J., & ... Riley, W. T. (2008). Tobacco use and cessation in psychiatric disorders: National Institute of Mental Health report. *Nicotine & Tobacco Research*, *10*(12), 1691-1715. doi:10.1080/14622200802443569

Zvolensky, M. J., Bernstein, A., Marshall, E. C., & Feldner, M. T. (2006). Panic attacks, panic disorder, and agoraphobia: Associations with substance use, abuse, and dependence. *Current Psychiatry Reports, 33*(S1), 279-285. doi:10.1007/s11920-006-0063-6

Zvolensky, M. J., Feldner, M. T., Leen-Feldner, E. W., & McLeish, A. C. (2005). Smoking and panic attacks, panic disorder, and agoraphobia: A review of the empirical literature. *Clinical Psychology Review*, *25*(6), 761-789. doi:10.1016/j.cpr.2005.05.001

Zvolensky, M. J., Lewinsohn, P., Bernstein, A., Schmidt, N. B., Buckner, J. D., Seeley, J.,... & Bonn-Miller, M. O. (2008). Prospective associations between cannabis use, abuse, and dependence and panic attacks and disorder. *Journal of Psychiatric Research*, *42*(12), 1017-1023. doi:10.1016/j.jpsychires.2007.10.012

Zvolensky, M. J., Vujanovic, A. A., Bernstein, A., Bonn-Miller, M. O., Marshall, E. C., & Leyro, T. M. (2007). Marijuana use motives: A confirmatory test and evaluation among young adult marijuana users. *Addictive Behaviors*, *32*(12), 3122-3130. doi:10.1016/j.addbeh.2007.06.010

*Table 1.* Cannabis Use Disorder DSM-IV-TR criteria

| **Cannabis Abuse** | **Cannabis Dependence** |
|---|---|
| One (or more) of the following:<br>(1) Recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home<br>(2) Recurrent substance use in situations in which it is physically hazardous<br>(3) Recurrent substance-related legal problems<br>(4) Continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance | Three (or more) of the following:<br>(1) Tolerance, as defined by either of the following:<br>(a) a need for markedly increased amounts of the substance to achieve intoxication or desired effect<br>(b) markedly diminished effect with continued use of the same amount of the substance<br>(2) The substance is often taken in larger amounts or over a longer period than was intended<br>(3) There is a persistent desire or unsuccessful efforts to cut down or control substance use<br>(4) A great deal of time is spent in activities necessary to obtain the substance, use the substance, or recover from its effects<br>(5) important social, occupational, or recreational activities are given up or reduced because of substance use<br>(6) the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance |

*Table 2.* Rates of Current Mood and Anxiety disorders

| **Axis I Diagnosis** | **Current % (n)** | **Lifetime % (n)** |
|---|---|---|
| Mood Disorder (≥1) | 40.0 (40) | -- |
| Major Depression | 19.0 (19) | -- |
| Dysthymia | 18.0 (18) | -- |
| Bipolar I or II | 4.0 (4) | -- |
| Anxiety Disorder (≥ 1) | 57.0 (57) | -- |
| Panic Disorder | 6.0 (6) | -- |
| Panic w/ Agoraphobia | 7.0 (7) | -- |
| Agoraphobia | 6.0 (6) | -- |
| Social Phobia | 10.0 (10) | -- |
| Specific Phobia | 6.0 (6) | -- |
| OCD | 3.0 (3) | -- |
| PTSD | 39.0 (39) | -- |
| GAD | 14.0 (14) | -- |
| Any SUD (≥1) | 32.0 (32) | 87.0 (87) |
| Alcohol | 25.0 (25) | 14.0 (14) |
| Amphetamine | 4.0 (4) | 41.0 (41) |
| Cocaine | 7.0 (7) | 63.0 (63) |
| Hallucinogen | -- | 29.0 (29) |
| Inhalant | -- | 6.0 (6) |
| Opioid | 4.0 (4) | 26.0 (26) |
| Sed., Hypnotic, or Anxio. | 2.0 (2) | 14.0 (14) |

*Note. Lifetime (past, but not current) Mood and Anxiety Disorders not assessed in current study; OCD = Obsessive-compulsive disorder; PTSD = Posttraumatic stress disorder; GAD = Generalized Anxiety Disorder; SUD = Substance use Disorder; Sed., Hypnotic, or Anxio. = Sedative, Hypnotic, or Anxiolytic classes of substances.*

*Table 3.* Descriptive Statistics and Correlations with Relevant Variables

| **Variable** | **Mean (*SD*) Or % (n)** | **1.** | **2.** | **3.** | **4.** | **5.** | **6.** | **7.** | **8.** | **9.** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Cannabis Quantity | 6.12 (2.06) | 1 | -.09 | .15 | .10 | .15 | .12 | -.02 | .05 | .18 |
| 2. Cannabis Frequency | 8.01 (18.03) | | 1 | -.05 | .04 | -.03 | -.04 | .06 | .10 | -.17 |
| 3. Alcohol Status | 55% (55) | | | 1 | -.11 | .10 | .04 | -.10 | -.03 | .16 |
| 4. Tobacco Status | 59% (59) | | | | 1 | -.04 | -.04 | -.13 | .04 | **-.01** |
| 5. IDAS-Dep | 48.48 (16.57) | | | | | 1 | **.70**** | **.28**** | **.22*** | **.30**** |
| 6. IDAS-Panic | 13.74 (6.50) | | | | | | 1 | **.21*** | .19 | .17 |
| 7. MPS | 6.78 (6.04) | | | | | | | 1 | **.28**** | .12 |
| 8. MMQ – Coping | 13.67 (4.70) | | | | | | | | 1 | .17 |
| 9. MEEQ – Tension Red. | 3.81 (0.73) | | | | | | | | | 1 |

*Note: *p* < .05; ***p* < .01; ****p* < .001*; Cannabis Quantity = Mean cannabis use per using day for 14 days prior to quit-day assessed by the Timeline Follow-Back (TLFB; Sobell & Sobell, 1992); Cannabis Frequency = Percent Days abstinent for 14 days prior to quit-day assessed by the Timeline Follow-Back (Sobell & Sobell, 1992); IDAS –Dep = Inventory of Depression and Anxiety Symptoms – General Depression (20 items; Watson et al., 2007); IDAS-Panic = Inventory of Depression and Anxiety Symptoms – Panic Subscale (8 items; Watson et al., 2007); MPS = Marijuana Problems Scale (Stephens et al., 2000); MMQ-Coping = Marijuana Motives Questionnaire (Simons et al., 1998); MEEQ –Tension Red.= Marijuana Effect Expectancies Questionnaire – Tension Reduction / Relaxation subscale (Schafer & Brown, 1991).*

*Table 4. Hierarchical Linear Regressions*

| DV | Step | $\Delta R^2$ | Predictors | B | $\beta$ | $sr^2$ |
|---|---|---|---|---|---|---|
| **MEEQ-Tension / Relaxation** | 1 | .058 | BL Cannabis Quant | .06 | .18 | .17 |
| | | | Alcohol Status | -.15 | -.10 | -.10 |
| | | | Tobacco Status | .17 | .11 | .11 |
| | 2 | .556 | MEEQ-Craving | .26 | **.28**** | .22 |
| | | | MEEQ-GlobalNeg | -.24 | **-.32**** | -.23 |
| | | | MEEQ-CogBehav | .07 | .08 | .05 |
| | | | MEEQ-Soc/Sexual | .20 | **.21*** | .14 |
| | | | MEEQ-Percept/Cog | .45 | **.46***** | .29 |
| | 3 | .007 | IDAS-Dep | -.01 | .08 | -.05 |
| | | | IDAS-Panic | .01 | .12 | .08 |
| | 4 | .039 | IDAS-DepxPanic | .01 | **.27**** | .20 |
| **MMQ-Coping** | 1 | .005 | BL Cannabis Quant | .17 | .07 | .07 |
| | | | Alcohol Status | .24 | .02 | .02 |
| | | | Tobacco Status | -.24 | -.02 | -.02 |
| | 2 | .365 | MMQ-Enhance | .03 | .03 | .02 |
| | | | MMQ-Conform | .19 | .18 | .14 |
| | | | MMQ-Expansion | .06 | .07 | .06 |
| | | | MMQ-Social | .44 | **.45**** | .30 |
| | 3 | .013 | IDAS-Dep | .02 | .06 | .04 |
| | | | IDAS-Panic | .06 | .07 | .05 |
| | 4 | .035 | IDAS-DepxPanic | -.01 | **-.26*** | -.19 |
| **MPS** | 1 | .029 | BL Cannabis Quant | .30 | .02 | .02 |
| | | | Alcohol Status | -1.24 | -.10 | -.10 |
| | | | Tobacco Status | -1.83 | -.15 | -.15 |
| | 2 | .098 | IDAS-Dep | .12 | **.34*** | .24 |
| | | | IDAS-Panic | -.04 | -.04 | -.03 |
| | 3 | .009 | IDAS-DepxPanic | -.01 | -.13 | -.09 |

*Note: *p < .05; **p < .01; ***p < .001; $\Delta R^2$ = R square change; B = unstandardized coefficient; β = Standardized beta weight provided for hierarchical multiple regression; sr2 = squared partial correlation; BL Cannabis Quantity = mean cannabis use per using day on the Timeline Follow-Back (TLFB; Sobell & Sobell, 1992), during the 14-day baseline period; Alcohol Status = Any alcohol use on the TLFB during the 14-day baseline period; Tobacco Status = Any tobacco use on the TLFB during the 14-day baseline period; IDAS-Dep = Inventory of Depression and Anxiety Symptoms – General Depression subscale, at baseline (Watson et al., 2007); IDAS-Panic = Inventory of Depression and Anxiety Symptoms – Panic subscale, at baseline (Watson et al., 2007); IDAS-DepxPanic = Interaction between IDAS-General Depression and Panic subscales; MPS = Marijuana Problems Scale (Stephens et al., 2000); MMQ – Coping = Marijuana Motives Questionnaire – Coping susbscale (Simons et al., 1998); MEEQ – Tension/Relaxation= Marijuana Expectancies Effect Questionnaire – Tension Reduction / Relaxation subscale (Schafer & Brown, 1991).*

*Table 5.* Proportional Hazard Regression Analyses

| DV | Step | Predictors | B | *Exp(B)* | *CI(95%)* |
|---|---|---|---|---|---|
| **Time to Lapse** | 1 | BL Cannabis | -.05 | .948 | .811-1.109 |
| | | Alcohol Status | -.26 | .769 | .484-1.222 |
| | | Tobacco Status | .30 | 1.346 | .845-2.144 |
| | 2 | IDAS-Dep | .01 | 1.006 | .988-1.025 |
| | | IDAS-Panic | .02 | 1.023 | .974-1.074 |
| | 3 | IDAS-DepxPanic | -.01 | .999 | .996-1.001 |
| **Time to Relapse** | 1 | BL Cannabis | -.11 | .892 | .732-1.086 |
| | | Alcohol Status | -.54 | .586 | .331-1.035 |
| | | Tobacco Status | .36 | **1.435**$^{+}$ | .845-2.439 |
| | 2 | IDAS-Dep | -.01 | .998 | .976-1.021 |
| | | IDAS-Panic | .05 | **1.05**$^{+}$ | .995-1.109 |
| | 3 | IDAS-DepxPanic | -.01 | .999 | .996-1.001 |

*Note:* $^{+}p < .08$; $*p < .05$; $**p < .01$, $***p < .001$; *B = unstandardized coefficient; Exp(B)=Hazards ratio; BL Cannabis Quantity = mean cannabis use per using day on the Timeline Follow-Back (TLFB; Sobell & Sobell, 1992) during the 14-day baseline period; Alcohol Status = Any alcohol use on the TLFB during the 14-day baseline period; Tobacco Status = Any tobacco use on the TLFB during the 14-day baseline period; IDAS-Dep = Inventory of Depression and Anxiety Symptoms – General Depression subscale, at baseline (Watson et al., 2007); IDAS-Panic = Inventory of Depression and Anxiety Symptoms – Panic subscale, at baseline (Watson et al., 2007); IDAS-DepxPanic = Interaction between IDAS-General Depression and Panic subscales; MPS = Marijuana Problems Scale (Stephens et al., 2000); Time to Lapse = Number of days post quit day until any cannabis use (measured by the TLFB); Time to Relapse = Number of days until the first day of a relapse, as defined by 4 days of use within a 7 day period (measured by the TLFB).*

*Figure 1*. Current model

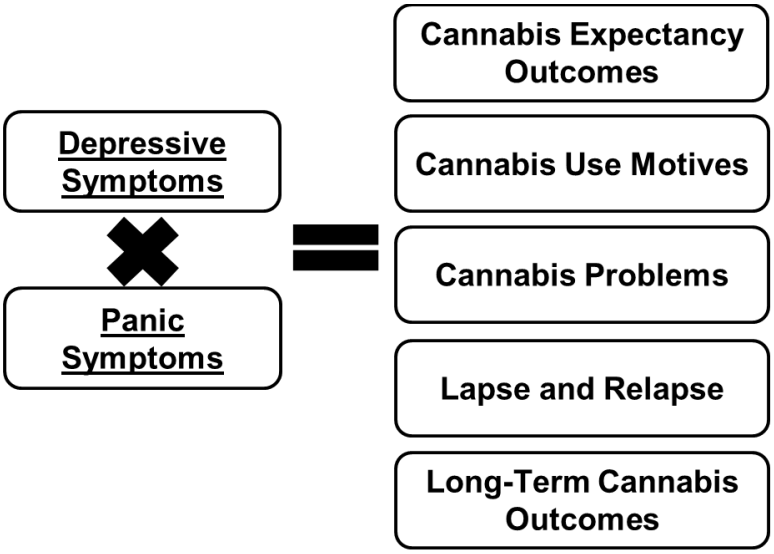
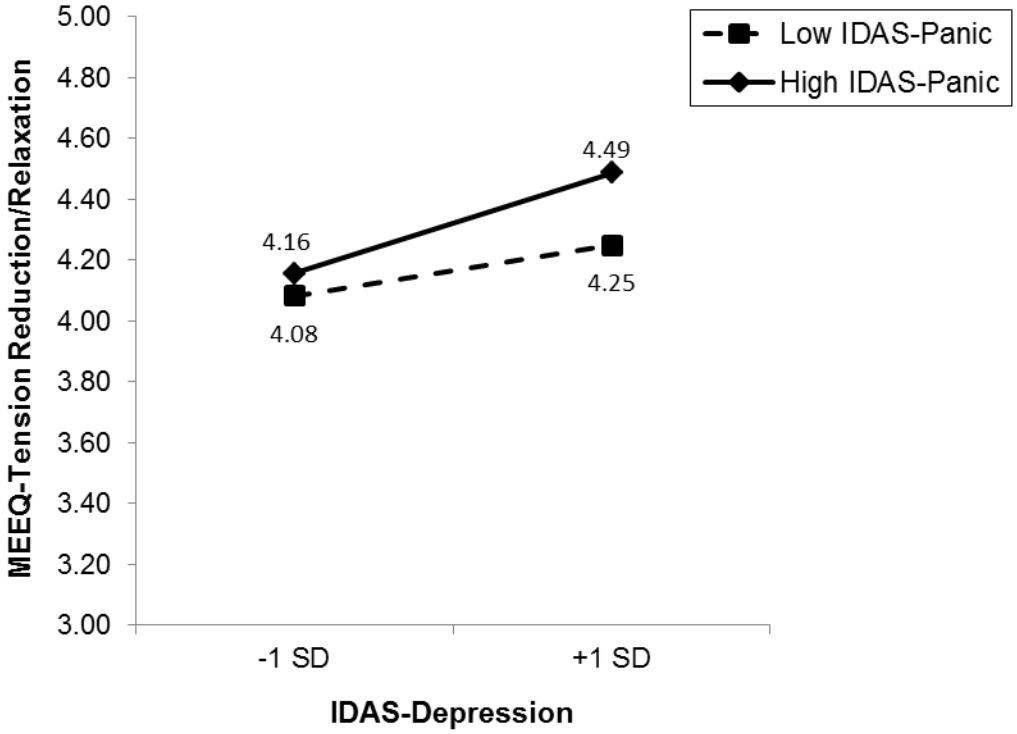
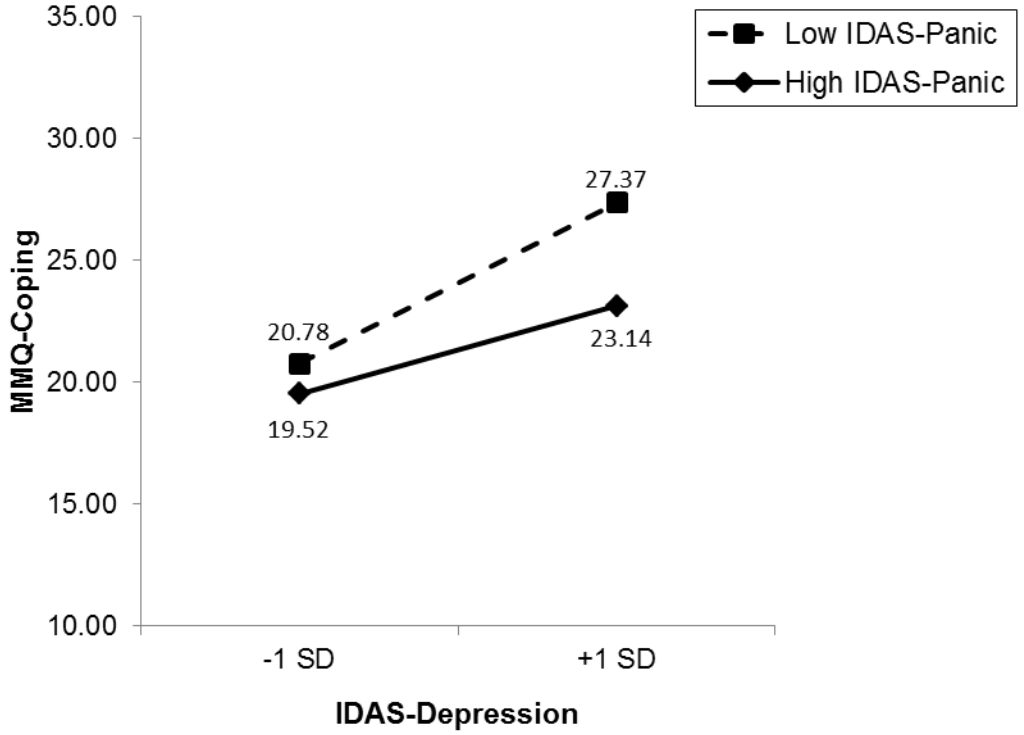


*Figure 2.* Plot of relations between IDAS-Depression and Panic on MEEQ-Tension Reduction/Relaxation




*Note. IDAS-Depression = Inventory of Depression and Anxiety Symptoms – General Depression subscale, at baseline (Watson et al., 2007); IDAS-Panic = Inventory of Depression and Anxiety Symptoms – Panic subscale, at baseline (Watson et al., 2007); MEEQ-Tension Reduction/Relaxation = Marijuana Expectancies Effect Questionnaire - Tension Reduction/Relaxation subscale (Schafer & Brown, 1991).*

*Figure 3.* Plot of relations between IDAS-Depression and Panic on MMQ-Coping




*Note. IDAS-Depression = Inventory of Depression and Anxiety Symptoms – General Depression subscale, at baseline (Watson et al., 2007); IDAS-Panic = Inventory of Depression and Anxiety Symptoms – Panic subscale, at baseline (Watson et al., 2007); MMQ-Coping = Marijuana Motives Questionnaire, Coping subscale (Simons et al., 1998*

*Figure 4.* Survival Plot of Lapse and Relapse over Time

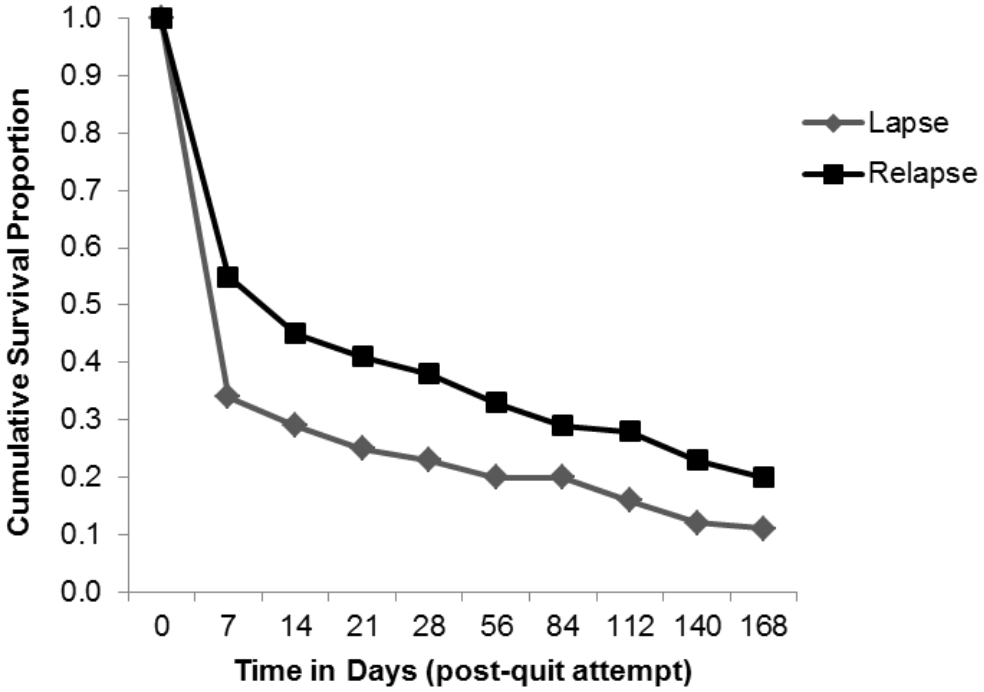
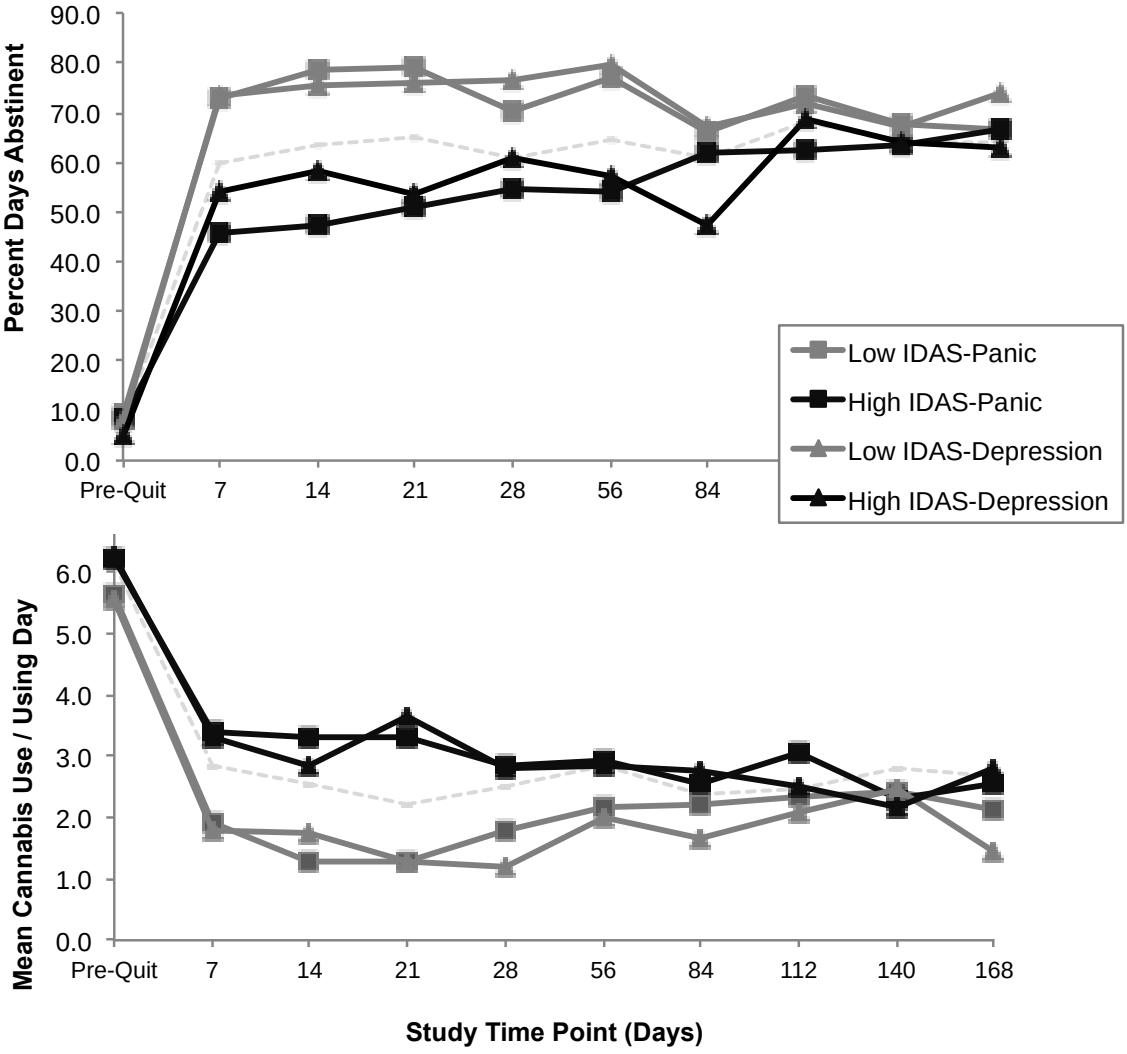


*Figure 5.* Frequency and Quantity of Cannabis Use over Time, by High and Low IDAS-Panic and IDAS-Depression



Appendix

**MARIJUANA SMOKING HISTORY QUESTIONNAIRE – VERSION 4**

For each question below, please write the number of the answer on the blank line(s) to the right of each item.

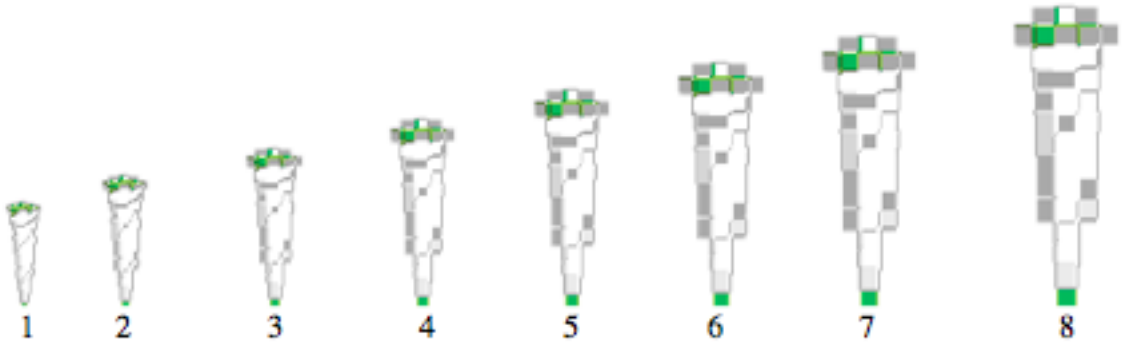
1. Do you currently or have you ever smoked marijuana? 1 = YES 0 = NO _____

2. Please rate your marijuana use in the past 30 days.

0 1 2 3 4 5 6 7 8 _____

No use Once a week More than once a day

3. On average, how much marijuana do you smoke per occasion (circle one)?




4. In your lifetime how many days have you smoked marijuana?

0 1 2 3 4 5 6 _____

No days More than 300 days

5. What is the **typical** means by which you consume marijuana (circle one)

a. Joint b. Bowl c. Bong d. One-hitter e. Ingestion (e.g. food)

6. In which of the following situations do you **typically** smoke marijuana (circle one)

a. Alone b. With two or three people c. With more than three people

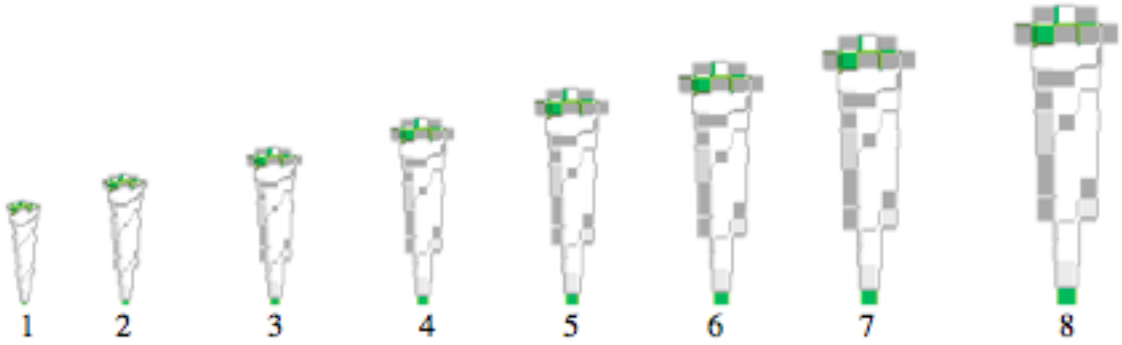
7. How old were you when you **first** smoked marijuana? (years) _____

8. How old were you when you started regular daily marijuana smoking? (years) _____

9. For how many years, altogether, have you been a regular daily marijuana smoker? _____

10. Think about your smoking during the **last week**, how much marijuana did you smoke

per occasion in an average day (circle one)?




11. Think about your smoking during the **last week**, how often did you smoke marijuana in an average day? _____

12. When were you smoking the **heaviest**? (year) _____

13. How many times in your life have you made a serious attempt to quit using marijuana? (If more than 9 times, put 9) _____

14. As best as you can remember, how long ago did you make your first attempt to quit marijuana smoking? (years) _____

15. How many years have you smoked marijuana? (total number of years) _____

16. How many different times in you life have you made an attempt to quit smoking marijuana where you have stayed off marijuana for 12 or more hours? (Do not include time sleeping) _____

17. Since you started smoking marijuana regularly, have you ever quit for a period of at least 24 hours? 1 = YES 0 = NO _____

18. Since you first started smoking marijuana, what was the **longest** period of time that you were able to stay off marijuana? (If less than 1 day, do not include time sleeping?

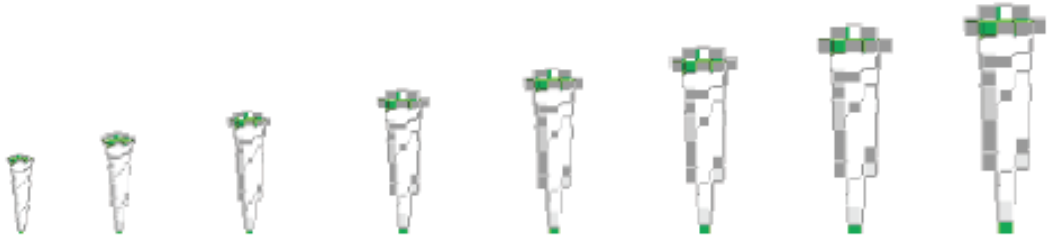
Years _____ Months _____ Days _____ Hours _____

19. Have you in the **past** had a disease or illness you believe was caused or aggravated by your smoking marijuana? 1 = YES 0 = NO _____

20. Do you have any symptoms **now** that you believe are caused by your smoking marijuana? 1 = YES 0 = NO _____

21. Do you have a disease or illness **now** that you believe is caused by or aggravated by your smoking marijuana? 1 = YES 0 = NO _____

# TIMELINE FOLLOWBACK CALENDAR: 2012




**Complete the Following**

**Start Date (Day 1):** _____ **End Date (yesterday):** _____

MO DY YR MO DY YR

| 2012 | SUN | MON | TUES | WED | THURS | FRI | SAT |
|---|---|---|---|---|---|---|---|
| | 1 New Year's | 2 | 3 | 4 | 5 | 6 | 7 |
| J | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| A | 15 | 16 M. L. King | 17 | 18 | 19 | 20 | 21 |
| N | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | 29 | 30 | 31 | 1 | 2 | 3 | 4 |
| F | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| E | 12 | 13 | 14 Valentine's Day | 15 | 16 | 17 | 18 |
| B | 19 | 20 Presidents' Day | 21 | 22 | 23 | 24 | 25 |
| | 26 | 27 | 28 | 29 | 1 Ash Wednesday | 2 | 3 |
| M | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A | 11 | 12 | 13 | 14 | 15 | 16 | 17 St. Patrick's Day |
| R | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| A | 1 | 2 | 3 | 4 | 5 | 6 Good Friday | 7 Passover |
| P | 8 Easter | 9 | 10 | 11 | 12 | 13 | 14 |
| R | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | 29 | 30 | 1 | 2 | 3 | 4 | 5 |
| M | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| A | 13 Mother's Day | 14 | 15 | 16 | 17 | 18 | 19 |
| Y | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| | 27 | 28 Memorial Day | 29 | 30 | 31 | | |

# TIMELINE FOLLOWBACK CALENDAR: 2012

**1 Standard Drink is Equal to**


One 12 oz can/bottle of beer


One 5 oz glass of regular (12%) wine


1 ½ oz of hard liquor (e.g. rum, vodka, whiskey)


1 mixed or straight drink with 1 ½ oz hard liquor

**Complete the Following**

Start Date (Day 1): _____ End Date (yesterday): _____

MO DY YR MO DY YR

| 2012 | SUN | MON | TUES | WED | THURS | FRI | SAT |
|---|---|---|---|---|---|---|---|
| | 1 New Year's | 2 | 3 | 4 | 5 | 6 | 7 |
| J | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| A | 15 | 16 M. L. King | 17 | 18 | 19 | 20 | 21 |
| N | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | 29 | 30 | 31 | 1 | 2 | 3 | 4 |
| F | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| E | 12 | 13 | 14 Valentine's Day | 15 | 16 | 17 | 18 |
| B | 19 | 20 Presidents' Day | 21 | 22 | 23 | 24 | 25 |
| | 26 | 27 | 28 | 29 | 1 Ash Wednesday | 2 | 3 |
| M | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A | 11 | 12 | 13 | 14 | 15 | 16 | 17 St. Patrick's Day |
| R | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| A | 1 | 2 | 3 | 4 | 5 | 6 Good Friday | 7 Passover |
| P | 8 Easter | 9 | 10 | 11 | 12 | 13 | 14 |
| R | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | 29 | 30 | 1 | 2 | 3 | 4 | 5 |
| M | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| A | 13 Mother's Day | 14 | 15 | 16 | 17 | 18 | 19 |
| Y | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| | 27 | 28 Memorial Day | 29 | 30 | 31 | | |

# TIMELINE FOLLOWBACK CALENDAR: 2012

One Standard Cigarette

**Complete the Following**

Start Date (Day 1): _____ End Date (yesterday): _____

MO DY YR MO DY YR

| 2012 | SUN | MON | TUES | WED | THURS | FRI | SAT |
|---|---|---|---|---|---|---|---|
| | 1 New Year's | 2 | 3 | 4 | 5 | 6 | 7 |
| J | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| A | 15 | 16 M. L. King | 17 | 18 | 19 | 20 | 21 |
| N | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | 29 | 30 | 31 | 1 | 2 | 3 | 4 |
| F | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| E | 12 | 13 | 14 Valentine's Day | 15 | 16 | 17 | 18 |
| B | 19 | 20 Presidents' Day | 21 | 22 | 23 | 24 | 25 |
| | 26 | 27 | 28 | 29 | 1 Ash Wednesday | 2 | 3 |
| M | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A | 11 | 12 | 13 | 14 | 15 | 16 | 17 St. Patrick's Day |
| R | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| A | 1 | 2 | 3 | 4 | 5 | 6 Good Friday | 7 Passover |
| P | 8 Easter | 9 | 10 | 11 | 12 | 13 | 14 |
| R | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | 29 | 30 | 1 | 2 | 3 | 4 | 5 |
| M | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| A | 13 Mother's Day | 14 | 15 | 16 | 17 | 18 | 19 |
| Y | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| | 27 | 28 Memorial Day | 29 | 30 | 31 | | |

**MARIJUANA EXPECTANCY QUESTIONNAIRE** **Date:** ☐☐ / ☐☐ / ☐☐

[rev. 10/26/94] 30 yr Page 1
(imeq.sav)

**The following pages contain statements about the effects of marijuana. Read each statement carefully and respond according to your own personal thoughts, feelings and beliefs about marijuana now. We are interested in what you think about marijuana, regardless of what other people might think.**

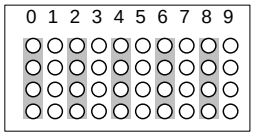
**<u>Whether or not you have had actual marijuana experiences yourself</u>, you are to answer in terms of your beliefs about marijuana. It is important that you respond to every question. There are no right or wrong answers.**

**PLEASE BE HONEST. REMEMBER, YOUR ANSWERS ARE CONFIDENTIAL. RESPOND TO THESE ITEMS ACCORDING TO WHAT YOU PERSONALLY BELIEVE TO BE TRUE ABOUT A MODERATE AMOUNT OF MARIJUANA -- HOWEVER YOU DEFINE MODERATE.**
**Fill in the circle which shows how much you agree or disagree with each item:**

| PLEASE USE A BLACK PEN<br>Shade circles like this: ●<br>Not like this: ⊘ ✓ | 1<br>DISAGREE STRONGLY | 2<br>DISAGREE SOMEWHAT | 3<br>UNCERTAIN | 4<br>AGREE SOMEWHAT | 5<br>AGREE STRONGLY |
|---|---|---|---|---|---|

| 1 | 2 | 3 | 4 | 5 | imeq1 |
|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | 1. Marijuana does not make me sleepy and tired. |
| ○ | ○ | ○ | ○ | ○ | 2. Marijuana makes small things seem intensely interesting. |
| ○ | ○ | ○ | ○ | ○ | 3. Smoking marijuana makes me hungry. |
| ○ | ○ | ○ | ○ | ○ | 4. Marijuana gives me a mellow feeling. |
| ○ | ○ | ○ | ○ | ○ | 5. Smoking marijuana increases my craving for things. |
| ○ | ○ | ○ | ○ | ○ | 6. I get a sense of relaxation from smoking marijuana. |
| ○ | ○ | ○ | ○ | ○ | 7. Marijuana disrupts my attention and I get easily distracted. |
| ○ | ○ | ○ | ○ | ○ | 8. Smoking marijuana makes me less tense or relieves anxiety; it helps me to unwind. |
| ○ | ○ | ○ | ○ | ○ | 9. Marijuana makes me carefree and I do not care about my problems as much. |
| ○ | ○ | ○ | ○ | ○ | 10. Smoking marijuana makes me feel agitated. |
| ○ | ○ | ○ | ○ | ○ | 11. I am not concerned about how others evaluate me when I am on marijuana. |
| ○ | ○ | ○ | ○ | ○ | 12. Smoking marijuana makes me feel like hiding in a corner. |
| ○ | ○ | ○ | ○ | ○ | 13. Marijuana makes me talk more than usual. |
| ○ | ○ | ○ | ○ | ○ | 14. After smoking marijuana, I become more quiet and tend not to socialize. |
| ○ | ○ | ○ | ○ | ○ | 15. I feel like I can focus on one thing better when I smoke marijuana. |
| ○ | ○ | ○ | ○ | ○ | 16. When I smoke marijuana I do not feel insecure. |
| ○ | ○ | ○ | ○ | ○ | 17. I have a better time at parties if I am smoking marijuana. |
| ○ | ○ | ○ | ○ | ○ | 18. Smoking marijuana does not make me thirsty. |
| ○ | ○ | ○ | ○ | ○ | 19. Marijuana makes me say things I do not mean. |
| ○ | ○ | ○ | ○ | ○ | 20. I am more sociable when I smoke marijuana. |
| ○ | ○ | ○ | ○ | ○ | 21. Marijuana makes me paranoid. |
| ○ | ○ | ○ | ○ | ○ | 22. Smoking marijuana makes me feel like part of the group. |
| ○ | ○ | ○ | ○ | ○ | 23. If I have been smoking marijuana, it is harder for me to concentrate and understand the meaning of what is being said. |
| ○ | ○ | ○ | ○ | ○ | 24. Marijuana slows thinking and actions. |
| ○ | ○ | ○ | ○ | ○ | 25. I become more creative or imaginative on marijuana. |
| ○ | ○ | ○ | ○ | ○ | 26. If I have been smoking marijuana it is harder to remember things. |
| ○ | ○ | ○ | ○ | ○ | 27. Marijuana makes time seem to slow down. |
| ○ | ○ | ○ | ○ | ○ | 28. I withdraw in social situations when I am on marijuana. |
| ○ | ○ | ○ | ○ | ○ | 29. Marijuana does not cause you to think less clearly. |
| ○ | ○ | ○ | ○ | ○ | 30. Marijuana makes reaction times slower. |

imeq30




*CONTINUE ON BACK OF PAGE* ⟶

## MARIJUANA EXPECTANCY QUESTIONNAIRE

[rev. 10/26/94] 30yr Page 2

**RESPOND TO THESE ITEMS ACCORDING TO A MODERATE AMOUNT OF MARIJUANA -- HOWEVER YOU DEFINE MODERATE:**

**PLEASE USE A BLACK PEN**
**Shade circles like this: ●**
**Not like this: ⊘ ✓**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| DISAGREE STRONGLY | DISAGREE SOMEWHAT | UNCERTAIN | AGREE SOMEWHAT | AGREE STRONGLY |

1 2 3 4 5 tpbardt

31. Things seem unreal and I feel out of touch with what is going on around me when I smoke marijuana.
32. My eyes do not become red and sore when I smoke marijuana.
33. Marijuana does not change the way I view things.
34. When I smoke marijuana it changes my vision or can make me have hallucinations.
35. I feel warm when I smoke marijuana.

36. When I smoke marijuana it helps me escape reality.
37. Marijuana changes the way my body feels; for example, light-headedness, tingly or dizzy sensations.
38. Marijuana makes me giggly and laugh a lot.
39. When I smoke marijuana I feel like I have heavy feet and no coordination.
40. Marijuana does not cause lung problems.

41. Music sounds different when I smoke marijuana.
42. Marijuana tastes and smells bad.
43. Marijuana does not make me uninhibited (unrestrained).
44. I am more willing to do things that I normally would not do when I smoke marijuana.
45. Things seem funny and less serious to me when I smoke marijuana.

46. I have a happy, good feeling when I smoke marijuana.
47. Marijuana causes me to lose control and become careless.
48. Marijuana makes it easier to escape from problems and responsibilities.
49. Smoking marijuana causes me to act pretty much the same.
50. I am less motivated when I smoke marijuana.

51. Marijuana can cause me to become depressed and disappointed with myself.
52. Marijuana causes euphoria (strong sense of well-being).
53. Marijuana can make my feelings change from happy to sad.
54. I act excited when I smoke marijuana.
55. Smoking marijuana is similar to being "high" from drinking alcohol.

56. Marijuana does not make me feel more romantic or attracted to members of the opposite sex.
57. After smoking marijuana my eyelids feel heavy and I become drowsy.
58. Marijuana can make me angry and possibly violent.
59. After the "high" of smoking marijuana, I feel down.
60. Marijuana does not alter my personality.

61. I feel sexy or more interested in sex after smoking marijuana.
62. Marijuana impairs my functioning, especially in school.
63. Marijuana makes me critical and short-tempered.
64. I get the "munchies" (craving for snacks) when I smoke marijuana.
65. It is difficult for me to express my thoughts clearly if I have been smoking marijuana.

66. Marijuana makes my mouth seem dry.
67. Marijuana makes me calm.
68. Marijuana changes my perception of time and distance.
69. I become anxious or uneasy on marijuana.
70. I am more relaxed in social situations if I have been smoking marijuana.

imeq70

*NEXT PAGE* ⟶

**Marijuana Motives Questionnaire**

Using the following scale, please consider all of the times that you have smoked marijuana and indicate how often you have smoked marijuana for each of the below reasons.

1----------2----------3----------4----------5
Almost never/ Never — Almost Always/ Always

_____1. To forget my worries
_____2. Because my friends pressure me to use marijuana
_____3. Because it helps me enjoy a party
_____4. Because it helps me when I feel depressed or nervous
_____5. To be sociable
_____6. To cheer me up when I am in a bad mood
_____7. Because I like the feeling
_____8. So that others won't kid me about not using marijuana
_____9. Because it's exciting
_____10. To get high
_____11. Because it makes social gatherings more fun
_____12. To fit in with the group I like
_____13. Because it gives me a pleasant feeling
_____14. Because it improves parties and celebrations
_____15. Because I feel more self-confident and sure of myself
_____16. To celebrate a special occasion with friends
_____17. To forget about my problems
_____18. Because it's fun
_____19. To be liked
_____20. So I won't feel left out
_____21. To know myself better
_____22. Because it helps me be more creative and original
_____23. To understand things differently
_____24. To expand my awareness
_____25. To be more open to experiences

**MPS**

Following are different types of problems you may have experienced as a result of smoking **marijuana**. Please circle the number that indicates whether this has been a problem for you in the **past 90 days.**

| **Has Marijuana use caused you:** | **No Problem** | **Minor Problem** | **Serious Problem** |
|---|---|---|---|
| 1. Problems between you and your partner | 0 | 1 | 2 |
| 2. Problems in your family | 0 | 1 | 2 |
| 3. To neglect your family | 0 | 1 | 2 |
| 4. Problems between you and your friends | 0 | 1 | 2 |
| 5. To miss days at work or miss classes | 0 | 1 | 2 |
| 6. To lose a job | 0 | 1 | 2 |
| 7. To have lower productivity | 0 | 1 | 2 |
| 8. Medical problems | 0 | 1 | 2 |
| 9. Withdrawal symptoms | 0 | 1 | 2 |
| 10. Blackouts or flashbacks | 0 | 1 | 2 |
| 11. Memory loss | 0 | 1 | 2 |
| 12. Difficulty sleeping | 0 | 1 | 2 |
| 13. Financial difficulties | 0 | 1 | 2 |
| 14. Legal problems | 0 | 1 | 2 |
| 15. To have lower energy level | 0 | 1 | 2 |
| 16. To feel bad about your use | 0 | 1 | 2 |
| 17. Lowered self-esteem | 0 | 1 | 2 |
| 18. To procrastinate | 0 | 1 | 2 |
| 19. To lack self-confidence | 0 | 1 | 2 |

**Motivation to Quit**

Please circle the one that most accurately describes your current thoughts about quitting marijuana use.

1) I enjoy using marijuana and have decided not to quit using marijuana for my lifetime.

2) I never think about quitting using marijuana, and I have no plans to quit.

3) I rarely think about quitting using marijuana, and I have no plans to quit.

4) I sometimes think about quitting using marijuana, but I have no plans to quit.

5) I often think about quitting using marijuana, but I have no plans to quit.

6) I definitely plan to quit using marijuana in the next 6 months.

7) I definitely plan to quit using marijuana in the next 30 days.

8) I still use marijuana, but I have begun to change, like cutting back on the amount of marijuana that I use per day. I am ready to set a quit date.

9) I have quit using marijuana, but I still worry about slipping back, so I need to keep working on living without marijuana.

10) I have quit using marijuana and I will never use again.