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Substance use consequences, mental health problems, and readiness to change among Veterans seeking substance use treatment

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Abstract

Individuals seeking substance use treatment who have one or more co-occurring mental health problems tend to have lower treatment engagement, higher rates of attrition, and poorer treatment outcomes. Readiness to change (RTC) is an integral construct in the recovery process, with higher RTC associated with improved treatment outcomes. However, the impact of psychiatric symptoms on RTC is not fully understood, especially among specialty subpopulations, such as military Veterans. Therefore, the aim of the present study was to examine the associations of mental health problems with RTC in a sample of Veterans initiating outpatient substance use treatment. The present sample was comprised of 278 Veterans (12% women, $M_{\text{age}} = 48.22$, $SD = 14.06$) who completed self-report intake measures assessing past month substance use frequency, substance-related consequences, symptoms of insomnia, depression, and anxiety, and importance and confidence to change one's substance use. Four separate canonical correlation analyses focusing on RTC alcohol, opioid, cannabis, and nicotine use were conducted. Veterans' inclusion in each analysis was not mutually exclusive. Results indicated that *greater* depression, anxiety, consequences, and frequency of alcohol use corresponded with *greater* importance to change alcohol use. Likewise, *greater* depression, anxiety, and insomnia symptoms along with frequency of use and consequences related to *greater* importance *and* confidence to change one's opioid use. In contrast, *greater* anxiety, depression, insomnia, and frequency of use were associated with *less* confidence in one's ability to change cannabis use. None of these variables were related to one's RTC nicotine use. Findings highlight the importance of assessing mental health problems at outset

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of substance use treatment, as they may be an indication of RTC and could be used as a catalyst to advance Veterans forward in the process of behavior change.

Keywords

readiness to change; mental health problems; substance use treatment; Veterans

1. Introduction

The co-occurrence of substance use and mental health problems is high among individuals seeking substance use disorder (SUD) treatment (Bose, Hedden, Lipari, & Park-Lee, 2016; Chan et al., 2008; McGovern et al., 2006; Watkins et al., 2004). Moreover, clients with co-occurring mental health symptoms tend to have more severe SUDs, greater functional impairment, more interpersonal and social problems, and more legal problems (McGovern et al., 2006; Schäfer & Najavits, 2007; Torrens et al., 2012), making it challenging to engage and retain these clients in treatment. For instance, studies have found mental health problems correspond with lower treatment engagement, higher rates of attrition, and poorer treatment outcomes in SUD patients (Bradizza et al., 2006; Compton et al., 2003; Krawczyk et al., 2017). These treatment challenges may be particularly relevant to U.S. military Veterans (Teeters et al., 2017), given that substance use and mental health problems are generally more frequent among Veterans than civilians (Hoggatt et al., 2017). Thus, a critical next step in understanding the challenges faced by Veterans with SUDs is examining the factors associated with treatment engagement, which may have important implications for identifying pathways to enhance treatment initiation and retention.

One mechanism to increase treatment initiation and retention is using targeted brief motivational interventions to increase readiness to change (RTC; Prochaska & DiClemente, 1992; Rollnick, 1998). RTC is conceptualized as a combination of one's perceived importance to make a change and confidence in ability to achieve it (i.e., self-efficacy; DiClemente et al., 2004; Rollnick, 1998). Both anecdotal and empirical reports indicate substantial variability in individuals' RTC their drinking and drug use behaviors when initiating SUD treatment (Carney & Kivlahan, 1995; Edens & Willoughby, 2000). For example, higher RTC, especially greater self-efficacy, has been associated with increased treatment engagement, more quit attempts, better treatment retention, sustained abstinence, and reduction of substance use among individuals with problematic drug and alcohol use (Bertholet et al., 2012; Carbonari & DiClemente, 2000; Joe et al., 1999; Project MATCH Research Group, 1997; Pantalon et al., 2002; Penberthy et al., 2007). The link between higher RTC and improved outcomes suggests that readiness could also inform precision medicine approaches (Collins & Varmus, 2015) by identifying those who are likely to do well in treatment and those who could potentially benefit from an initial brief intervention aimed at increasing motivation to change, boosting commitment to change, and identifying change goals and plans followed by cognitive or behavioral interventions.

Because RTC appears to be a critical factor associated with treatment success, several studies have examined factors that account for differences in RTC alcohol and drug

behaviors (DiClemente et al., 2009). Excessive use of drugs and alcohol can have a wide variety of deleterious effects including loss of family and friends, physical injury, and financial and legal problems. Numerous studies have demonstrated that greater recognition of such consequences has been linked to more desire and willingness for substance use change (e.g., Blume & Schmalting, 1996, 1998; Blume et al., 2006; Carey et al., 2007; DiClemente et al., 2009; Palfai et al., 2002). Indeed, increasing awareness of substance-related consequences is considered an integral component in the process of behavior change (Prochaska & DiClemente, 1992; Rollnick, 1998) and is a primary focus in treatments aimed at increasing motivation to reduce one's use or abstain all together (Miller & Rollnick, 2012).

Not only do psychosocial consequences of substance use impact RTC, but the co-occurrence of mental health problems also may play an important role in increasing RTC (Blume & Schmalting, 1998; Blume et al., 2001; Smith & Tran, 2007). Although some mental health problems (e.g., depression, anxiety, and insomnia) may be a trigger for substance use as an attempted coping mechanism (i.e., negative reinforcement), withdrawal and sustained heavy use may in turn lead to the co-occurrence of these problems or exacerbate existing psychiatric symptoms (Cerdá et al., 2008; DuPont & Gold, 2007; Hall et al., 2009). Existing studies have shown that chronic substance use is associated with increased rates of mental health problems, such as depression, anxiety, and insomnia (Ferguson, Boden, & Horwood, 2011; Volkow, Baler, Compton, & Weiss, 2014; Conroy & Arnedt, 2014). The deleterious impact substance use has on these psychological problems may subsequently increase individuals' desire to change their alcohol and/or drug use. This could occur because the consequences of continued use come to outweigh the positive aspects of using. Furthermore, the initial reinforcing effects of substance use, such as elevation in mood and improvement in sleep (Buckner et al., 2015; Whiting et al., 2015), may diminish with continued heavy use (Berridge & Robinson, 2016), potentially reducing individuals' initial motivation for using substances as coping mechanisms (Bonn-Miller, Boden, Bucossi, & Babson, 2014; Cooper, Frone, Russell, & Mudar, 1995; McCabe Cranford, Boyd, & Teter, 2007).

There is also evidence to support the notion that mental health problems may enhance individual's RTC. For instance, in one study, impaired mental and physical health was found to be the primary reason for seeking treatment among individuals who use cannabis (van der Pol et al., 2013). Other studies also have shown that greater endorsement of depressive symptoms correspond with greater RTC among female, but not male, tobacco smokers (Haukkala et al., 2000), college student risky drinkers (Smith & Tran, 2007), patients dually-diagnosed with SUD and mental health disorders participating in an inpatient treatment program (Blume, & Schmalting, 1998; Blume et al., 2001), and among problem gamblers (Gomes & Pascual-Leone, 2009). However, some studies have linked depression with lower self-efficacy for tobacco smoking cessation (Haukkala et al., 2000; Kanfer & Zeiss, 1983). These findings suggest that mental health problems may inconsistencies highlight the importance of examining these variables across populations given that results differ based on a variety of demographic and substance-specific factors.

To date, relatively little research has examined the associations between other mental health problems (e.g., anxiety, insomnia) with RTC substance use, despite these being common co-

occurring diagnoses. For example, anxiety has been found to be as common, if not more common, in individuals who use alcohol or drugs as depression (Lasser et al., 2000; Grant, et al., 2004; Seal et al., 2011), and findings suggest a positive association between anxiety and RTC drinking behavior among college student risky drinkers (Smith & Tran, 2007). Moreover, anxiety symptoms accounted for greater variability in RTC scores compared to depressive symptoms, highlighting its potential importance as a mechanism for increasing RTC. Although informative, these prior findings were drawn primarily from samples of college student drinkers and high functioning alcohol-dependent participants with little psychiatric comorbidity. Additionally, they have focused almost entirely on RTC alcohol use. Thus, it remains unclear whether these findings extend to other types of substances, to other substance using populations, such as Veterans, or to other treatment settings, especially outpatient treatment where a large portion of SUD treatment is conducted in the US (Fuller & Hiller-Sturmhöfel, 1999; SAMHSA, 2013).

Current Study

The present study aimed to expand prior research by examining the associations among mental health problems (e.g., depression, anxiety, insomnia) and RTC substance use among Veterans seeking outpatient SUD treatment. Rather than focusing solely on alcohol as has been done in prior studies, we assessed RTC for alcohol and other frequently used substances in this population including marijuana, opioids, and nicotine. In addition, we took a more nuanced approach to evaluating the associations between mental health problems and RTC by focusing on the RTC components of importance to change and self-efficacy. Understanding the associations different mental health problems have with importance to change and self-efficacy may have important implications in optimizing treatment planning at the outset of care. We hypothesized mental health problems to be positively associated with importance to change substance use based on the ideas that substance use may exacerbate symptoms and/or the acute effects of substances become less reinforcing with time. We also hypothesized mental health problems to be negatively associated with self-efficacy as individuals may perceive themselves as less able to change their use due to problems associated with their mental health.

It also is important to understand whether psychiatric conditions are associated with RTC apart from other relevant factors such as frequency of substance use and related consequences. As aforementioned, Veterans seeking substance use treatment frequently are at risk for a cluster of mental health symptoms and tend to have more problematic use and more severe substance-related problems (Chan et al., 2008; McGovern et al., 2006; Watkins et al., 2004), which may in turn increase one's RTC substance use (e.g., Blume et al., 2006; DiClemente et al., 2009). Thus, it is possible that any association co-occurring mental health problems have with RTC may be attributable to more severe use and problems. Therefore, we tested these hypotheses using Canonical Correlation Analysis (CCA; Tabachnic & Fidel, 2007), which is a statistical approach that allowed us to control for the interrelations among all study variables to produce a robust model of related predictors of importance to change and self-efficacy within each substance-specific subsample of Veterans seeking outpatient SUD treatment.

2. Materials and methods

2.1 Participants

Data were drawn from a clinical program evaluation dataset consisting of Veterans seeking outpatient SUD treatment between November, 2015 and June, 2016 at a Veteran's Affairs Medical Center in the Midwest. A total of 279 Veterans completed an intake assessment packet as part of routine care and their packets were turned in to be coded and stored electronically. The sample was primarily comprised of middle-aged ($M_{age} = 48.2$, $SD = 14.1$), male (88%) Veterans. Additionally, 49% of these Veterans were single/divorced/widowed, 94% were heterosexual, 75% were White, and most had either a high school (44%) or two-year college (32%) education. In terms of military experience, almost one-half (46%) had been exposed to combat during their service, and most of the sample had been in the Army (56%), Navy (19%), or Marines (15%), serving an average of 5.2 ($SD=4.3$) years. All procedures were approved by the VA's institutional review board.

2.2 Measures

2.3.1. Insomnia.—The Insomnia Severity Index (ISI) is a 7-item measure that assesses the nature, severity, and impact of insomnia over the past week (Morin, 1993). Veterans rated each item using a 5-point Likert scale (0 “Not at all” to 4 “Extremely”). The ISI has been validated with objective (polysomnography) and subjective (clinical interviews and sleep diary data) measures of insomnia (Bastien et al., 2001). Higher scores indicate more severe insomnia, with scores above 15 indicating moderate to severe insomnia (Morin, 1993). Internal reliability (Cronbach's α) in the present sample was .92.

2.3.2. Depression.—The Patient Health Questionnaire 9 (PHQ-9) is a 9-item measure of depression severity based on DSM-IV criteria for depression (Kroenke et al., 2001). Veterans rated how bothered they were by each item over the past two weeks on a 4-point scale (0 “Not at all” to 3 “Nearly every day”). The PHQ-9 has good construct validity and is a reliable measure of depression (Martin et al., 2006). Higher scores indicate more severe depression, with scores of 10 or greater suggesting clinically significant depression (Kroenke et al., 2001). Internal reliability (Cronbach's α) in the present sample was .90.

2.3.3. Anxiety.—The Generalized Anxiety Disorder 7 (GAD-7) is a brief scale that measures general anxiety symptoms based on the DSM-IV criteria for GAD (Spitzer et al., 2006). Veterans rated how bothered they were by each item over the past two weeks on a 4-point scale (0 “Not at all” to 3 “Nearly every day”). The GAD-7 has good internal consistency and criterion validity (Löwe et al., 2008). Higher total scores reflect more severe levels of anxiety, with scores of 10 or greater indicating clinically significant anxiety (Spitzer et al., 2006). Internal reliability (Cronbach's α) in the present sample was .94.

2.3.4. Substance-related problems.—The Short Index of Problems (SIP; Blanchard, Morgenstern, Morgan, Labouvie, & Bux, 2003) is a 15-item measure assessing problems resulting from drug or alcohol use. Veterans indicated the frequency with which they experienced each substance-related problem in the past 30 days on a 4-point scale (0 “Never,” 1 “Once or a few times,” 2 “Once or twice a week,” 3 “Daily or almost daily”). A

total index score of problems caused by use can be calculated by summing together all items. Internal reliability (Cronbach's α) in the present sample was .96.

2.3.5. Substance use.—The Brief Addiction Monitor-Revised (BAM-R; Cacciola et al., 2013) is 17-item measure evaluating recent alcohol and drug use, use risk factors, and protective factors. Those single, open-ended BAM-R items that assessed frequency of past month alcohol, opioid, and cannabis use were used in present analyses. While the BAM-R assesses for other substances, the number of veterans endorsing these substances did not permit inclusion in the present analyses (e.g., cocaine: $n=23$, other stimulants: $n=9$, sedatives: $n=26$, inhalants: $n=0$). As the BAM-R does not assess nicotine use, the Fagerstrom Test of Nicotine Dependence (Heatherton et al., 1989), which included quantity of use, was used as a proxy for current daily nicotine consumption.

2.3.6. Readiness to change (RTC).—Importance to change and self-efficacy one could change were assessed using modified items from the Readiness Ruler (CASAA, 1995; Miller, 1999). These self-report measures asked participants to rate how important it was for them to change their use of four specific substances and how confident they were that they could change their use of each substance. Participants responded using a 1–10 continuum with the anchor points “not ready to change,” “unsure,” “ready to change,” and “trying to change.” If a Veteran did not use a substance, they were instructed to mark “Don't Use.” Readiness rulers have been found to perform equivalently to standard multiple item questionnaires in assessing RTC drinking behavior (LaBrie et al., 2005).

2.4. Data Analyses

Study aims were evaluated by conducting a series of canonical correlation analyses (CCAs; Tabachnick & Fidell, 2007). Inclusion of Veteran data in each analysis was not mutually exclusive due to endorsement of polysubstance use. CCA was chosen because it is a form of multivariate correlation that allows the researcher to include multiple related independent and dependent variables in the same analysis. Because multiple independent and dependent variables are entered into the regression simultaneously, CCA also allows for interpretation of the dimensional relations that may exist within the set of independent and dependent variables while controlling for the intercorrelations among all variables entered in the model (Tabachnick & Fidell, 2007). If a significant canonical correlation exists, then the model will produce two canonical variates, an independent variate which is comprised of variables from the independent set, and a dependent variate which is comprised of variables from the dependent set. Each variable will have a standardized canonical function coefficient, which is interpreted as the relative weight (e.g., similar to beta weight in regression) each variable contributes to that canonical variate, and variables with a coefficient of $>.40$ are interpreted as a meaningful variable in the set (for more details see Sherry & Henson, 2005). Finally, a redundancy coefficient is calculated for each canonical variate, which presents the proportion of variance in one set of variables that is explained by the variant in the other set of variables (similar to R^2 in multiple regression; Dattalo, 2014). We used three CCAs to evaluate the potential dimensional relations between the following independent variables (1) depression, anxiety, insomnia, substance use-related consequences, past 30-day substance use frequency and the following dependent variables (2) importance of changing substance

use and cessation self-efficacy for Veterans who sought treatment for each of three types of substances (i.e., alcohol, cannabis, opioids). We then conducted an identical CCA for Veterans who reported nicotine use, except that we used Fagerstrom scores as a proxy for recent consumption. Sample sizes for each CCA varied based on the number of Veterans who endorsed using each of the four types of substances (alcohol: $n = 176$; cannabis: $n = 64$; opioids: $n = 53$; nicotine: $n = 72$).

3. Results

3.1. Descriptive Statistics

Mean ratings (SD) for importance to change alcohol, cannabis, opioid, and nicotine use, respectively, were 7.47 (3.2), 4.20 (3.50), 6.73 (3.76), and 5.43 (3.18). Mean confidence ratings (SD) were comparable to those for importance (alcohol: $M=7.92$ [2.53]; cannabis: $M=6.04$ [3.54]; opioid: $M=6.96$ [3.29]; nicotine: $M=5.11$ [3.11]) except for cannabis, $t_{paired(79)}=4.52$, $p<.001$, with Veterans who use cannabis reporting greater confidence in their ability to change cannabis behavior than importance of change. Mean (SD) ISI, PHQ-9, and GAD-7 scores were 15.21 (7.29), 12.23 (7.00), and 10.28 (6.78), respectively, all of which are above recommended cutoffs for clinically-significant symptoms. All measures of mental health problems were moderately to strongly correlated ($r_s=.57-.77$, $p<.001$), with the strongest association between depression and anxiety. Substance-related problems ($M=18.86$, $SD=14.34$) had a moderate, positive association with each mental health problem ($r_s=.34-.49$, $p<.001$). Table 1 presents sample characteristics within each substance type. Of note, subgroups based on substance type are not mutually exclusive and may share data for demographic and predictor variables.

3.2. Factors Associated with Readiness to Change Alcohol Use

Table 2 reveals that there was one significant canonical correlation ($R_c = .44$). For the independent set, the canonical variate was represented primarily by use-related consequences, depression, frequency of alcohol use, and anxiety, and the canonical variate for the dependent set was represented primarily by importance to change alcohol use. The amount of variance in the independent set explained by dependent set was .40, and the amount of variance in the dependent set explained by the independent set was .08. This analysis revealed that importance to change alcohol use, but *not* confidence, was *positively* related to alcohol use-related consequences, depression, anxiety, and alcohol use frequency, while controlling for the intercorrelation among all variables.

3.3. Factors Associated with Readiness to Change Cannabis Use

Table 3 reveals that there was one significant canonical correlation ($R_c = .47$). For the independent set, the canonical variate was represented primarily by depression, anxiety, insomnia, and frequency of cannabis use, and the canonical variate for the dependent set was represented primarily by confidence to change cannabis use. The amount of variance in the independent set explained by dependent set was .38, and the amount of variance in the dependent set explained by the independent set was .08. This analysis revealed that self-efficacy, but *not* importance of change, was *negatively* related to insomnia, anxiety,

depression, and cannabis use frequency, while controlling for the intercorrelation among all variables.

3.4. Factors Associated with Readiness to Change Opioid Use

Table 4 reveals that there was one significant canonical correlation ($R_c = .55$). For the independent set, the canonical variate was represented primarily by use-related consequences, frequency of opioid use, anxiety, depression, and insomnia, and the canonical variate for the dependent set was represented primarily by both importance to change opioid use and confidence that one could change. The amount of variance in the independent set explained by dependent set was .42, and the amount of variance in the dependent set explained by the independent set was .13. This analysis revealed that *both* importance to change opioid use and perceived self-efficacy about this change were *positively* related to substance use-related consequences, depression, anxiety, opioid use frequency, and insomnia, while controlling for the intercorrelation among all variables.

3.5. Factors Associated with Motivation to Change Nicotine Use

Lastly, Table 5 reveals that there were no significant canonical correlations between the dimension of independent variables (e.g., insomnia, depression, anxiety, substance use-related consequences, and severity of nicotine dependence) and dependent variables (RTC nicotine use).

4. Discussion

The present study expands the extant literature on the link between mental health problems and RTC substance use by examining the associations between the severity of depression, anxiety, and insomnia symptoms and RTC across different substance types in a sample of treatment-seeking Veterans while accounting for the interrelation of all mental health and substance use variables. Overall, findings reveal that depression, anxiety, and insomnia were related to the level of importance Veterans place on making a change to their substance use and their perceived self-efficacy they could succeed. Notably, the associations these mental health problems have with RTC is differentiated based on the type of substance used. For alcohol use, Veterans who endorsed more problems related to depression, anxiety, or drinking also reported higher levels of importance to change their alcohol use. Similar relationships were observed among Veterans who use opioids, with the addition of insomnia being positively related to importance for this group. Opioid-using Veterans who endorsed more psychiatric symptoms and/or who reported more substance-related problems also rated their self-efficacy to change as higher. By contrast, neither depression, anxiety, insomnia, nor substance-related problems were associated with the level of importance to change cannabis use. Instead, these mental health problems, but not substance use problems, were negatively associated with Veterans' confidence to change cannabis use. Additionally, none of the mental health problems nor substance-related problems assessed in this study were associated with the levels of importance and confidence to change nicotine use.

A vital process in changing substance use is resolving the ambivalence regarding whether making a change is important and whether one has the ability to achieve it (Rollnick, 1998).

The present study suggests a link between co-occurring mental health problems, such as depression, anxiety, and insomnia, and readiness for substance use change among treatment-seeking Veterans. Specifically, Veterans who use alcohol or opioids who also have co-occurring symptoms of depression, anxiety, or insomnia may have a higher level of RTC when beginning outpatient treatment compared to Veterans who use cannabis or nicotine. These findings replicate and extend previous studies with undergraduate drinkers and dually-diagnosed psychiatric inpatients (Blume, & Schmaling, 1996, 1997, 1998; Blume et al., 2001; Smith & Tran, 2007), supporting the robustness of the associations depression and anxiety have with RTC across different substance-using populations. Moreover, the observed elevated levels of importance for alcohol and opioid use change in the present study may be attributable to the deleterious effects these substances have on mental health problems like depression, anxiety, and sleep, thereby, increasing the burden of continued use (Cerdá et al., 2008; DuPont & Gold, 2007; Hall et al., 2009). This exacerbation of these mental health problems may be a significant reason explaining why Veterans seek treatment and may make them more willing to engage in treatment. Furthermore, engagement in concurrent or integrative treatments for substance use and comorbid mental health problems may be critical if quit or reduction attempts are to be successful. Examining the influence mental health problems have on RTC various substances as a potential mediator of treatment outcomes is an important future direction for research.

Self-efficacy beliefs have also been identified as one of the most consistent predictors for drinking and drug use outcomes (Adamson et al., 2009; Kadden & Litt, 2011). In the present study, endorsement of depression, anxiety, and insomnia symptoms corresponded only with perceived self-efficacy among Veterans who use opioids or cannabis, with associations in opposite directions. Interestingly, for opioid-using Veterans, greater endorsement of depression, anxiety, and insomnia symptoms appear to indicate greater belief in one's ability to successfully reduce use of opioid use. However, the underlying mechanisms and psychosocial processes contributing to this association are unclear. Nevertheless, our findings suggest that opioid-using Veterans with co-occurring mental health problems may be most likely to engage in treatment as they believe change is both important and achievable, which is consistent with the broader MI literature (Adamson et al., 2009; Kadden & Litt, 2011). However, assuming many of these patients are using opioids to manage chronic pain conditions (Bourdreau et al., 2009), providing other interventions for pain management (e.g., cognitive behavioral therapy for chronic pain; acceptance and commitment therapy; Wetherell et al., 2011) may be critical in order to increase their ability to cope with pain without relying on supplemental substance use as an acute analgesic. Such individualized efforts are also consistent with an MI approach because they recognize the importance of negotiating an individualized change goal and plan (Miller & Rollnick, 2012), and can be adapted throughout a treatment episode based on the needs of the individual

By contrast, among Veterans who use cannabis, depression, anxiety, and insomnia corresponded with lower levels of self-efficacy about reducing use, potentially explaining why individuals who use cannabis and report greater psychological distress have higher rates of treatment attrition (Roffman et al., 1993). Lower levels of self-efficacy are also consistent with the negative reinforcing effects of cannabis use, such as coping with depression, anxiety, and insomnia (Bonn-Miller et al., 2010; Bonn-Miller et al., 2009). In one study,

greater self-perceived dependence on marijuana was found to be associated with greater pre-treatment attrition (Vendetti et al., 2002). Prior findings also suggest greater participation in goal setting activities (Lozano & Stephens, 2010), coping skills training (e.g., social skills, communication skills; DiClemente et al., 2001; Ilgen et al., 2007; Litt et al., 2008), or 12-step programs (Aase et al., 2008; McKellar et al., 2008) may improve self-efficacy over other treatment options (e.g., Motivational Enhancement Therapy; Romo et al., 2009). Our findings suggest that such treatment strategies may be particularly relevant for cannabis-using Veterans who endorse symptoms of depression, anxiety, or insomnia. However, MI interventions might be successful in this population if providers spend more time developing therapeutic alliance with these individuals, perhaps through the “engaging” MI skills (i.e., open-ended questions, affirmations, reflections, and summaries; Miller & Rollnick, 2012), which are especially important when working with individuals with low self-efficacy (Ilgen et al., 2006). Providers might also consider reduction, as opposed to abstinence, as an initial treatment goal for Veterans reluctant to give up cannabis use completely due to low self-efficacy. Such intervention efforts could be tailored to help Veterans learn coping skills that might apply to managing negative affect of sleep-related difficulties, and thus reduce the negative reinforcing effects of continued cannabis use (Bonn-Miller et al., 2010; Bonn-Miller et al., 2009).

The present study has several more important implications for engaging Veterans in treatment for substance use problems. For example, our findings underscore the importance of routinely screening for RTC and for depression, anxiety, and insomnia in Veterans initiating SUD treatment, especially because screening for co-occurring mental health problems is often underutilized in SUD treatment (Mauro et al., 2016). These co-occurring problems may not only provide an indication of RTC but could also be used as a catalyst to advance Veterans forward in efforts to change their substance use (DiClemente et al., 2004). One of the most important implications of the present study is that mental health screeners could improve treatment planning with respect to which components of RTC (importance vs. self-efficacy) may need to be targeted early in treatment (Annis et al., 1996), which aligns with precision medicine approaches that facilitate individualized intervention components (Collins & Varmus, 2015). It is possible that providing the right level of MI intervention in early stages of treatment could make further MI efforts, like focusing, evoking, and planning (Miller & Rollnick, 2012), more successful. Engagement in other concurrent mental health treatment may also be critical to increasing ways of coping with such problems in order to reduce perceived reliance on supplemental substance use. Future research should examine how the associations between psychiatric symptoms and RTC across different drug types predict longitudinal treatment engagement, retention, and outcomes. Some research suggests that, at least with individuals dually-diagnosed with serious mental illness and substance use problems, RTC is not related to treatment engagement (Brown et al., 2011). However, other studies report greater RTC corresponds with better treatment engagement (Nidecker et al., 2009) and outcomes (Tate et al., 2008; Warren et al., 2007) among dually-diagnosed individuals, possibly because greater RTC among these individuals made it easier to commit to change, negotiate an individualized change goal, and make specific plans to change. Future research should examine this hypothesis using a rigorous longitudinal design.

4.1. Limitations

The present findings should be considered in the context of the study limitations. Although our study relied on a strong set of self-report measures under naturalistic treatment conditions, these measures have some limitations. For example, substance related consequences assessed in the present study were not substance specific, limiting our ability to distinguish whether an endorsed problem is attributable to one substance or another, or multiple substances. For this reason, we are unable to elucidate the distinct associations substance-specific problems may or may not have with RTC. Furthermore, we did not assess other mental health problems that commonly co-occur with substance use problems (e.g., posttraumatic stress disorder, panic disorder). Future studies would benefit from the utilization of more comprehensive and multisource assessments (e.g., medical records, informant report) of psychiatric symptoms and substance use. Moreover, the cross-sectional design of this study precludes making causal inferences about the associations depression, anxiety, and insomnia have with individuals' importance to change and self-efficacy. Although the associations between these symptoms and readiness to change are consistent with previous studies (e.g., Smith & Tran, 2007; Blume & Schmalzing, 1998; Blume et al., 2001), it does not rule out the possibility that these relationships could be spurious. In addition, certain external motivators for seeking substance use treatment, such as legal issues and pressure from friends and family, were not measured or accounted for in the present study. It is unclear how such external motivators might influence our findings. Lastly, participants were predominantly middle-aged, White, male Veterans recruited from a single medical center in the Midwest, which may limit generalizability to a more heterogeneous population in a dissimilar geographic location.

5. Conclusions

In summary, the present study extends the literature on RTC substance use among those with co-occurring mental health problems by demonstrating that endorsement of symptoms related to depression, anxiety, and insomnia corresponds with different levels of RTC. Additionally, these findings broaden the literature by applying these models among a sample of U.S. military Veterans initiating outpatient SUD treatment. Importantly, the directions of the associations appear to vary based on the type of substance used. This study contributes to the literature underscoring the importance of assessing co-occurring mental health problems, as they may give some indication to Veterans' initial RTC at the outset of treatment. Additional research is needed to understand how the associations between mental health problems and RTC impact treatment engagement, retention, and outcomes, and how they may inform treatment planning.

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Table 1.Sample characteristics of participants separated by substance type¹

Variable		Alcohol <i>n</i> = 176	Cannabis <i>n</i> = 64	Opioid <i>n</i> = 53	Nicotine <i>n</i> = 72
Male	%	88.60	93.70	90.60	91.50
Age	<i>M</i>	46.61	44.97	45.17	45.72
	<i>SD</i>	13.83	12.29	13.01	13.75
Race					
White	%	72.70	65.60	79.20	76.40
Black	%	13.60	15.60	5.70	11.10
American Indian/Alaskan Native	%	0.60	1.60	0.00	0.00
Asian/Pacific Islander	%	0.60	0.00	0.00	0.00
Hispanic/Latino	%	1.80	0.00	0.00	1.40
Multi-racial	%	10.80	17.20	15.10	11.10
Married	%	32.30	17.40	41.50	33.30
Heterosexual	%	96.00	95.30	98.10	98.60
Military Service					
Army	%	55.68	64.01	64.15	55.56
Years served	<i>M</i>	5.75	5.70	5.38	5.25
	<i>SD</i>	4.41	4.07	3.95	3.00
Combat exposure	%	44.90	48.40	49.10	44.40
Substance-related problems	<i>M</i>	19.24	19.58	22.91	19.40
	<i>SD</i>	14.28	14.56	15.19	14.92
Insomnia	<i>M</i>	15.15	15.30	17.04	14.08
	<i>SD</i>	7.32	7.49	6.25	7.03
Depression	<i>M</i>	12.26	12.30	13.89	11.75
	<i>SD</i>	6.88	6.63	6.71	6.12
Generalized anxiety	<i>M</i>	10.46	11.89	11.77	10.01
	<i>SD</i>	6.77	6.76	6.71	6.14

¹Subgroups based on substance type are not mutually exclusive and may overlap.

Table 2.

Means, Standard Deviations, and Canonical Correlations for alcohol variables

	Canonical Variate			
			1	2
Canonical Correlations ^a			<i>.44*</i>	.16
	<i>M</i>	<i>SD</i>	Independent Variables	
Insomnia	15.15	7.32	<i>-.31</i>	<i>-.23</i>
Depression	12.26	6.88	<i>-.67</i>	<i>-.52</i>
Generalized Anxiety	10.46	6.77	<i>-.48</i>	<i>.05</i>
Substance-Related Problems	19.24	14.28	<i>-.91</i>	<i>.18</i>
Drinking Frequency	11.90	11.61	<i>-.61</i>	<i>.10</i>
Redundancy Coefficient			.40	.02
	<i>M</i>	<i>SD</i>	Dependent Variables	
Importance	7.55	3.20	<i>-.88</i>	<i>.47</i>
Confidence	7.85	2.62	<i>.09</i>	<i>.996</i>
Redundancy Coefficient			.08	.61

Note. The standardized canonical function coefficients (italicized values) in the table are those used in the equation to combine the independent and dependent variables into two canonical variates. These variates are then correlated to produce the canonical correlation. Thus, the standardized canonical function coefficients are interpreted as the relative contribution (i.e., weight) that each variable contributes to that canonical variate (for further details, see Sherry & Henson, 2005). Values in bold represent statistically significant loadings for each canonical correlation.

* $p < .001$

^aFirst Canonical Correlation $F(10, 338) = 4.247, p < .001$

Table 3.

Means, Standard Deviations, and Canonical Correlations for cannabis variables

	Canonical Variate			
			1	2
Canonical Correlations ^a			<i>.47*</i>	<i>.33</i>
	<i>M</i>	<i>SD</i>	Independent Variables	
Insomnia	15.30	7.49	<i>.56</i>	<i>-.07</i>
Depression	12.30	6.63	<i>.91</i>	<i>-.21</i>
Generalized Anxiety	11.86	6.76	<i>.70</i>	<i>-.60</i>
Substance-Related Problems	19.58	14.56	<i>.17</i>	<i>-.56</i>
Cannabis Use Frequency	7.36	10.93	<i>.47</i>	<i>-.22</i>
Redundancy Coefficient			<i>.38</i>	<i>.06</i>
	<i>M</i>	<i>SD</i>	Dependent Variables	
Importance	4.33	3.61	<i>-.13</i>	<i>-.99</i>
Confidence	6.17	3.63	<i>-.90</i>	<i>-.43</i>
Redundancy Coefficient			<i>.08</i>	<i>.58</i>

Note. The standardized canonical function coefficients (italicized values) in the table are those used in the equation to combine the independent and dependent variables into two canonical variates. These variates are then correlated to produce the canonical correlation. Thus, the standardized canonical function coefficients are interpreted as the relative contribution (i.e., weight) that each variable contributes to that canonical variate (for further details, see Sherry & Henson, 2005). Values in bold represent statistically significant loadings for each canonical correlation.

* $p < .05$

^aFirst Canonical Correlation $F(10, 114) = 2.274, p < .05$

Table 4.

Means, Standard Deviations, and Canonical Correlations for opioid variables

			Canonical Variate	
			1	2
Canonical Correlations ^a			<i>.55*</i>	<i>.24</i>
	<i>M</i>	<i>SD</i>	Independent Variables	
Insomnia	17.04	6.25	<i>.44</i>	<i>.57</i>
Depression	13.89	6.71	<i>.54</i>	<i>-.16</i>
Generalized Anxiety	11.77	6.71	<i>.58</i>	<i>-.11</i>
Substance-Related Problems	22.91	15.19	<i>.87</i>	<i>-.17</i>
Opioid Use Frequency	11.09	12.97	<i>.73</i>	<i>.29</i>
Redundancy Coefficient			.42	.02
	<i>M</i>	<i>SD</i>	Dependent Variables	
Importance	7.23	3.57	<i>.998</i>	<i>-.07</i>
Confidence	7.13	3.31	<i>.55</i>	<i>-.84</i>
Redundancy Coefficient			.13	.35

Note. The standardized canonical function coefficients (italicized values) in the table are those used in the equation to combine the independent and dependent variables into two canonical variates. These variates are then correlated to produce the canonical correlation. Thus, the standardized canonical function coefficients are interpreted as the relative contribution (i.e., weight) that each variable contributes to that canonical variate (for further details, see Sherry & Henson, 2005). Values in bold represent statistically significant loadings for each canonical correlation.

* $p < .05$

^aFirst Canonical Correlation $F(10, 92) = 2.186, p < .05$

Table 5.Means, Standard Deviations, and Canonical Correlations for nicotine variables ($n=72$)

			Canonical Variate	
			1	2
Canonical Correlations ^a			.24	.17
	<i>M</i>	<i>SD</i>	Independent Variables	
Insomnia	14.08	7.03	<i>-.31</i>	<i>.74</i>
Depression	11.75	6.12	<i>-.53</i>	<i>.02</i>
Generalized Anxiety	10.01	6.14	<i>-.44</i>	<i>-.14</i>
Substance-Related Problems	19.40	14.92	<i>.37</i>	<i>.28</i>
Fagerstrom Scale	3.99	2.62	<i>.70</i>	<i>-.04</i>
Redundancy Coefficient			.24	.02
	<i>M</i>	<i>SD</i>	Dependent Variables	
Importance	5.58	3.29	<i>.12</i>	<i>.993</i>
Confidence	5.36	3.22	<i>-.74</i>	<i>.67</i>
Redundancy Coefficient			.01	.72

Note. The standardized canonical function coefficients (italicized values) in the table are those used in the equation to combine the independent and dependent variables into two canonical variates. These variates are then correlated to produce the canonical correlation. Thus, the standardized canonical function coefficients are interpreted as the relative contribution (i.e., weight) that each variable contributes to that canonical variate (for further details, see Sherry & Henson, 2005). Values in bold represent statistically significant loadings for each canonical correlation.

^a
ns