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Depression, posttraumatic stress, and alcohol misuse in young adult veterans: The transdiagnostic role of distress tolerance

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Abstract

Background—Alcohol misuse is common among young adult veterans, and is commonly associated with depression and posttraumatic stress disorder (PTSD). In fact, rates of comorbid depression, PTSD, and problem drinking are high in this population. Although distress tolerance, the capacity to experience and withstand negative psychological states, has been examined as a potential transdiagnostic factor that accounts for the development of mental health disorders, problem drinking, and the comorbidity between these presenting concerns, its role has not been evaluated in a veteran population.

Methods—Young adult veterans were recruited for an online survey related to alcohol use. Participants ($n = 783$) completed self-report measures of alcohol use, depression and PTSD symptoms, and distress tolerance. Mediation models were conducted to examine whether distress tolerance mediated the relationship between (1) probable PTSD, (2) probable depression, and (3) comorbid probable PTSD and depression with alcohol misuse. Moderated mediation models were conducted to examine gender as a moderator.

Results—Significant bivariate associations were observed among mental health symptoms, distress tolerance, and alcohol misuse. Distress tolerance significantly mediated the relationship between probable depression and PTSD (both alone and in combination) and alcohol misuse. Evidence of moderated mediation was present for probable PTSD and probable comorbid PTSD and depression, such that the indirect effect was stronger among males.

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Conflict of Interest

No conflict declared

Contributors

SBH participated in the design of the current analyses and performed the statistical analyses. ERP participated in the design and coordination of the study. AL participated in the design of the current analyses. All authors participated in drafting the manuscript, and read and approved the final manuscript.

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Conclusions—These results suggest that distress tolerance may be a transdiagnostic factor explaining the comorbidity of depression and PTSD with alcohol misuse in young adult veterans. These findings may inform screening and intervention efforts with this high-risk population.

Keywords

veterans; alcohol misuse; depression; PTSD; distress tolerance; mediation

1. INTRODUCTION

1.1 Alcohol use, PTSD, depression, and their co- and tri-morbidity among young adult veterans

Heavy alcohol use, depression, and posttraumatic stress disorder (PTSD) are among the most common mental health problems among young adult veterans. Estimated rates of alcohol misuse in veterans from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) range from 13–39% (Burnett-Zeigler et al., 2011; Eisen et al., 2012; McDevitt-Murphy et al., 2010). Moreover, there is evidence that the highest rates of alcohol misuse occur among the youngest veterans. Younger veterans and service members are most likely to engage in heavy weekly drinking (Jacobson et al., 2008) and binge drinking (Bray and Hourani, 2007; Jacobson et al., 2008; Ramchand et al., 2011), experience alcohol-related problems (Jacobson et al., 2008), and meet criteria for alcohol misuse (Burnett-Zeigler et al., 2011; Seal et al., 2011).

Depression and PTSD are frequently comorbid with problem drinking in veterans (Petrakis et al., 2011). Seal et al. (2011) found that among OEF/OIF veterans diagnosed with an alcohol use disorder (AUD), 63% were also diagnosed with PTSD and 54% with depression. There is evidence that a diagnosis of PTSD or depression increases the likelihood of alcohol misuse among OEF/OIF veterans, possibly due to attempts to avoid or numb oneself from the symptoms of hyperarousal or negative affect (Burnett-Zeigler et al., 2011; Jakupcak et al., 2010). However, it is important not to overlook the high rates of comorbid depression and PTSD in this population. In a representative sample of OEF/OIF veterans, roughly two-thirds of those who screened positive for PTSD also screened positive for depression (Schell and Marshall, 2008). Given the independent association of each diagnosis with problem drinking, it is perhaps unsurprising that the co-occurrence of PTSD and depression would be associated with alcohol misuse. In fact, a study of OEF/OIF veterans referred to Department of Veterans Affairs (VA) medical clinics found that 7% of veterans screened positive for PTSD and alcohol misuse and 4% screened positive for depression and alcohol misuse; however, even more striking is that 19% screened positive for depression, PTSD, and alcohol misuse, suggesting much higher rates of trimorbidity than would be assumed based on chance co-occurrence (Seal et al., 2008).

Veterans with AUDs and co-occurring depression and/or PTSD symptoms experience poor functioning in several areas of their lives, such as poor family relationships, homelessness, employment difficulties, low life satisfaction, suicidality, and physical health complaints (McDevitt-Murphy et al., Britton et al., 2015; Carter et al., 2011; 2010; Possemato et al., 2010; Yoon et al., 2015). Although OEF/OIF veterans are in general difficult to engage in

needed mental health care services (Burnett-Zeigler et al., 2011; Schell and Marshall, 2008; Seal et al., 2010), veterans with comorbid problems are even less likely to seek care to address their drinking or comorbid mental health problems (Erbes et al., 2007). Therefore, it is critical to understand the factors that may explain the comorbidity of these mental health concerns with alcohol misuse in veterans. This effort has the potential to guide screening, prevention, and intervention efforts designed to reduce mental health problems, problem drinking, and their comorbidity.

1.2 Role of distress tolerance in psychiatric and substance use comorbidity

Distress tolerance – “the capacity to experience and withstand negative psychological states” (Simons and Gaher, 2005, pg. 83) – is one factor that may link mental health and substance use. Low distress tolerance is associated with a range of mental health disorders, including PTSD (Marshall-Berenz et al., 2010; Vujanovic et al., 2011a) and depression (Peterson et al., 2014; Williams et al., 2013). Low distress tolerance has also been associated with increased alcohol use (Buckner et al., 2007; Wolitzky-Taylor et al., 2015) and more serious cannabis-related problems (Bujarski et al., 2012), and implicated in poor treatment outcomes among individuals who misuse substances, including shorter durations of recent abstinence attempts (Daughters et al., 2005b) and early treatment dropout (Daughters et al., 2005a).

Although some research has examined the role that distress tolerance plays in the relationship between co-occurring mental health disorders and substance use, these studies have varied widely in their focus and methods. These studies have examined a range of outcomes, such as alcohol and substance use frequency (e.g., Duranceau et al., 2014), alcohol and substance use motives (e.g., Marshall-Berenz et al., 2011; Vujanovic et al., 2011b), and treatment success (e.g., Daughters et al., 2005a). They have also differed with respect to statistical methods, examining both moderation (e.g., Ali et al., 2015; Tull et al., 2012) and mediation (e.g., Potter et al., 2011; Wolitzky-Taylor et al., 2015) models.

Despite this variability, there is increasingly theoretical support for the examination of distress tolerance as a statistical mediator that empirically accounts for the covariance between mental health problems and substance use. The rationale is that low distress tolerance may be a common risk factor that gives rise to both mental health problems and substance use, and may be a shared etiological factor that underlies the comorbidity. Low distress tolerance promotes maladaptive coping responses to distress from mental health problems. In turn, these maladaptive coping responses paradoxically exacerbate the intensity and frequency of distress because they may promote avoidance behaviors, thereby disrupting the process of habituation that might otherwise diminish the negative affect provoked by aversive internal or external stimuli (Leventhal and Zvolensky, 2015; Leyro et al., 2010). Such processes may lead to a variety of symptoms and behaviors that could promote both PTSD and depression, such as reduced access to certain rewards for which the pursuit of may be distressing at times (e.g., learning difficult new skills for career advancement), which could diminish opportunities for positive affect and produce anhedonia. Low distress tolerance may also directly promote substance use as one maladaptive means to avoid or delimit the experience of distress via the negative reinforcing effects of substance use (Leventhal and Zvolensky, 2015), regardless of severity of the

manifested affect. That is, it is not how much distress one experiences, but how one responds to distress that could give rise to substance use as a maladaptive response to distress that promotes avoidance among people with low distress tolerance who lack the capacity to endure negative affect states (Brown et al., 2005).

There is some empirical support for this hypothesis. Distress tolerance has been identified as an explanatory factor in the relationship between PTSD symptoms and substance use motives in trauma-exposed community members (Potter et al., 2011; Vujanovic et al., 2011b), and in the relationship between depression and substance use-related problems in undergraduate students (Buckner et al., 2007). However, other studies have not found a significant mediating effect (e.g., (Wolitzky-Taylor et al., 2015)). Given the limited body of literature, there is a need to better explore the transdiagnostic role of distress tolerance.

1.3 Present Study

Research on distress tolerance and substance use to date has not studied veterans. Given that young adult military veterans are at highest risk for problem drinking (Bray and Hourani, 2007; Burnett-Zeigler et al., 2011; Jacobson et al., 2008; Ramchand et al., 2011; Seal et al., 2011), a focus on alcohol misuse in young adult veterans is particularly needed. In addition, no studies to our knowledge have examined factors that may explain why people with both PTSD and depression are at increased risk of alcohol problems. The young veteran population provides a unique opportunity to examine such patterns of “tri-morbidity” concerns that could yield insights into other populations suffering from such problems.

Consequently, the current cross-sectional study examined the interrelations between distress tolerance, depression and PTSD symptoms, and alcohol misuse in a sample of young adult U.S. military veterans. More specifically, we examined distress tolerance as a statistical mediating factor to test whether it may serve as a transdiagnostic mechanism underlying both mental health symptoms and alcohol use (Leventhal and Zvolensky, 2015).

We expected that distress tolerance would significantly mediate the relationship between each mental health problem (depression, PTSD) and problem drinking. In addition, some previous research has examined gender as a moderator of the relationship between mental health, distress tolerance, and substance use (Ali et al., 2015; Bujarski et al., 2012; Tull et al., 2012; Wolitzky-Taylor et al., 2015). The results of these studies were mixed, with some results suggesting the mediating role of distress tolerance is stronger among males (Tull et al., 2012), others suggesting the effect is stronger among females (Ali et al., 2015), and still others suggesting no moderating effect (Wolitzky-Taylor et al., 2015). Given significant efforts to connect women veterans with needed mental health services (U.S. Department of Veterans Affairs, 2013), as well as evidence for gender differences in rates of mental health diagnoses and alcohol use in veterans (Haskell et al., 2010; Maguen et al., 2010), we examined the effect of gender on the mediated relationship between mental health, distress tolerance, and alcohol misuse in an effort to better understand the pathways underlying mental health issues and problem alcohol use in female veterans. Given the equivocal nature of previous research, we did not set an a priori hypothesis about the role of gender in the moderated mediation models.

2. METHODS

2.1 Participants and procedure

These data were collected as part of a larger randomized controlled trial evaluating a brief, online alcohol norms-based intervention for heavy drinking by young adult veterans (Pedersen et al., under review). As part of this study, participants completed a baseline questionnaire assessing a number of factors, including demographic characteristics, drug and alcohol use, and mental health symptoms. The present study focuses on responses on this baseline questionnaire to items related to our aims and hypotheses.

To be eligible for the study, participants had to be between 18 and 34 years of age and a military veteran. Members of the Coast Guard, those on active duty, or those still affiliated with the military through the reserves or guard were excluded. Because the focus of this study was on veterans who misuse alcohol, participants had to score 4 or above (for males) or 3 or above (for females) on the Alcohol Use Disorders Identification Test (AUDIT; Bradley et al., 2003, 1998; Saunders et al., 1993). These cutoff scores were used to identify individuals screening positive for problem drinking (Bradley et al., 2003, 1998).

Participants were recruited through Facebook, where targeted advertisements focused on recruiting young adult veterans for a “confidential online study about alcohol use.” Interested participants could click on ads and were directed to a secure website where they could indicate consent, complete a screening questionnaire for eligibility, and if eligible, complete a baseline survey. Participants received a \$20 Amazon electronic gift card via email if they completed the baseline survey. A total of 2,312 people clicked on Facebook ads, of which 1,177 indicated consent and completed a brief screening questionnaire to determine eligibility. Of those screened, 173 were screened out due to ineligibility (e.g., 85 scored lower than 4/3 on the AUDIT, 34 indicated they were still on active duty) or due to not providing consistent responses to “check items” to remove potential misrepresenters (e.g., responses of 12 participants were inconsistent on branch of service and rank at discharge), 210 started the survey but did not progress past initial screening items, and 11 were determined to be invalid responses after close inspection of the data (e.g., completed the survey too quickly to be legitimate). Complete data were thus available for 783 young adult veterans. All participants provided informed consent, and this study was approved by the local institutional review board.

2.2 Measures

2.2.1 Demographics—Participants completed questions related to demographic characteristics. This included questions related to military service (e.g., branch of service, length of service, number of deployments), as well as an 11-item combat exposure questionnaire (Schell and Marshall, 2008), the responses to which were dichotomized to reflect whether participants had combat experience (yes/no).

Because the survey was administered online with no face-to-face contact with participants, we utilized a series of checks from our prior work with young veterans (Pedersen et al., 2015a) to verify veteran status. This included targeted Facebook advertising that only displayed ads to individuals that met specific criteria, such as age between 18 and 34 and

those who expressed interest in popular veteran groups on Facebook (e.g., they “liked” the page for Iraq and Afghanistan Veterans of American). Participants were screened out if they indicated they were on active duty, not a veteran, or were currently in the reserves/guard. In addition, responses to questions related to age, branch of service, and other military service characteristics (i.e., pay grade at discharge, rank at discharge) needed to be consistent and accurate to identify participants who may be misrepresenting themselves as veterans.

2.2.2 Alcohol use—Alcohol use was assessed with the Alcohol Use Disorders Identification Test (AUDIT), a 10-item measure assessing frequency and quantity of alcohol use, alcohol-related behaviors, and alcohol-related problems. Response options vary for each question, but options range from 1 to 4. Higher scores indicate more problematic alcohol use. This measure has been validated on veteran populations (Crawford et al., 2013). Participants also completed the Daily Drinking Questionnaire (DDQ; Collins et al., 1985), a measure of alcohol consumption used in other studies with military samples (Neighbors et al., 2014; Pedersen et al., 2015b), which was used to describe the drinking behavior of the sample. This measure asks participants to identify a typical week in the last 30 days and indicate the number of drinks consumed each day of that week.

2.2.3 Mental health—As indicated, the mental health concerns of interest were PTSD and depression, which were operationalized using common screening instruments.

PTSD symptoms were measured with the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). The PCL-5 comprises 20 items that correspond to the DSM-5 criteria for PTSD. Participants indicate how often they have been bothered by each of the symptoms over the past month. Response options range from 0 (*not at all*) to 4 (*extremely*). Scores were dichotomized to reflect individuals with a probable PTSD diagnosis using a cutoff score of 33 (Bovin et al., 2015). Although we did not require veterans to provide details regarding an index trauma, the instructions included in the survey provided several examples of such stressful experiences (e.g., serious accidents, combat, assault, natural disasters, life threatening illness) and asked participants to keep one of these stressful experiences in mind (if applicable) when completing the PCL.

Depressive symptoms were measured with the Patient Health Questionnaire – 8 (PHQ-8; Kroenke et al., 2009). This measure assesses how frequently an individual has been bothered by each of eight symptoms of depression over the past 2 weeks. Response options range from 0 (*not at all*) to 3 (*nearly every day*). Scores were dichotomized to identify individuals with probable depression using a cutoff score of 10 (Kroenke et al., 2009). Those who surpassed the cutoff score on both the PCL-5 and the PHQ-8 were considered to have probable comorbid depression and PTSD. Because we wanted to provide results that have clinical utility, we used cutoff scores for both measures to identify veterans with/without probable depression and/or PTSD rather than the continuous symptom scores, as these screening measures are commonly used in this manner in clinical settings.

2.2.4 Distress tolerance—Distress tolerance was measured with the Distress Tolerance Scale (DTS) (Simons and Gaher, 2005). This 15-item scale assesses four aspects of an individual’s response to distressing situation: (a) the ability to tolerate distress; (b) negative

appraisals of being distressed; (c) ability to regulate distress; and (d) extent to which an individual's attention is focused on the experience of distress. Respondents are asked to describe their beliefs about being distressed, and response options range from 1 (*strongly agree*) to 5 (*strongly disagree*). Higher scores reflect greater distress tolerance. This measure has been used in other studies examining the mediating role of distress tolerance (e.g., Bujarski et al., 2012; Marshall-Berenz et al., 2011; Potter et al., 2011; Vujanovic et al., 2011b). Because prior studies generally examine total scores on the DTS, we focused on total scores in our analyses.

2.3 Data analysis

Data were analyzed using SPSS 21. Descriptive statistics were calculated for demographic variables, mental health variables, and alcohol-related variables. Bivariate correlations among measures were conducted to (a) examine the relationship among the primary variables of interest (i.e., PTSD and depression symptoms, distress tolerance, problem drinking), and (b) identify any demographic variables that should be included in subsequent analyses as covariates. Depending on the nature of each variable, these analyses included Pearson's and point biserial correlations, chi square, independent measures t-tests, and one-way ANOVAs. Mediation analyses were conducted using the PROCESS macro (Hayes, 2013) using 10,000 bootstrap samples. Three mediation models were conducted to examine distress tolerance as a mediator the relationship between alcohol misuse (the outcome of interest) and (a) probable PTSD, (b) probable depression, and (c) probable comorbid PTSD and depression. In these analyses, scores on the AUDIT were used to operationalize alcohol misuse. Given that this a cross-sectional study, it is possible that there are alternate patterns of association between mental health, alcohol problems, and distress tolerance than the sequence tested in the primary results. Hence, we ran an exploratory analysis of three reverse (or other alternate) mediation models for each of the primary analyses described above: (1) a model reversing the independent variable (IV) and dependent variable (DV), (2) a model reversing the IV and mediating variable (MV), and (3) a model reversing the MV and DV. Because PROCESS does not allow for dichotomous mediators, models reversing the IV and MV were tested using alternative methods (Iacobucci, 2012; Tofighi and MacKinnon, 2011). In addition, moderated mediation analyses were conducted to determine whether gender was a significant moderator of these effects.

3. RESULTS

3.1 Characteristics of the sample

Most participants were male (83%), non-Hispanic (90%), and white (85%). The mean age was 28.88 years ($SD = 3.39$). Most participants were Army veterans (60%), followed by Marine Corps (22%), Air Force (10%), and Navy (9%). For complete demographic information, see Table 1. Regarding military history, the mean length of service was 5.59 years ($SD = 2.78$), and the mean number of deployments was 1.51 ($SD = 1.23$). Approximately 82% ($n = 644$) of participants reported some combat exposure.

Seven percent of participants reported attending any appointments for help with an alcohol use problem from a VA or non-VA facility in the past year, and only 15.0% reportedly

received care for an alcohol use concern (e.g., help with drinking less, attending groups to stay abstinent from alcohol) since separation from the military. About one-third (31.4%) had not sought care at a VA for any reason since separation.

All participants reported alcohol use in the past year (per eligibility criteria on the AUDIT) and nearly all participants reported drinking at least once during the past 30 days ($n = 764$; 98%). On average, participants reported drinking on 4.16 days ($SD = 2.16$, range = 0–7) during a typical week, and those who drank in the past month consumed an average of 4.21 drinks on days that they drank ($SD = 2.88$, range = 1–21). The mean AUDIT score was 12.48 ($SD = 7.02$, range = 3–37), which represented a moderate level of alcohol problems for the sample on average (Babor et al., 2001).

Almost half of the sample (47%; $n = 365$) screened positive for probable depression on the PHQ-8, and 39% ($n = 271$) screened positive for probable PTSD on the PCL-5.

Approximately 35% ($n = 271$) of the sample screened positive for both probable PTSD and depression. Regarding rates of comorbidity, 88% of those who screened positive for PTSD also screened positive for depression, and 74% of those screening positive for depression also screened positive for PTSD. The mean score on the DTS was 3.16 ($SD = 1.04$, range = 1–5).

3.2 Bivariate relationships among variables

Analyses revealed significant correlations among the primary variables of interest (PCL-5, PHQ-8, DTS, and AUDIT) (see Table 2). Regarding demographic characteristics, gender was significantly associated with scores on the AUDIT, $t(781) = 4.22$, $p < .01$, and DTS, $t(781) = 3.96$, $p < .01$, with males scoring higher on both measures. There was a significant relationship between ethnicity (Hispanic vs. non-Hispanic) and probable PTSD ($\chi^2 = 5.42$, $df = 1$, $p = .02$), with a greater proportion of Hispanics screening positive for probable PTSD. Race was significantly associated with DTS scores ($F(2, 78) = 5.12$, $p < .01$) (post hoc Scheffe analyses indicated that Black participants had lower DTS scores than White participants) and probable depression, with a greater proportion of Black participants screening positive for depression ($\chi^2 = 8.65$, $df = 2$, $p = .01$). Age was not significantly correlated with the variables of interest.

3.3 Distress tolerance as a mediating factor

Because gender, race, and ethnicity were associated with certain variables of interest, they were included as covariates in the mediation models. Results indicated that DTS scores significantly mediated the relationship between probable PTSD and AUDIT scores, though the direct effect remained significant. There was also evidence that DTS scores partially mediated the relationship between probable depression and AUDIT scores, as well as the relationship between comorbid depression and PTSD and AUDIT scores. (See Table 3). However, the results of the reverse and other alternate mediation models were also significant.

3.4 Gender as a moderator

Evidence for moderated mediation by gender was found for the effect of probable PTSD on AUDIT scores through DTS, such that the both the direct and indirect effects of a positive PTSD screen on alcohol use via DTS was stronger for male veterans than female veterans. There was also evidence of moderated mediation for veterans who screened positive for both PTSD and depression, with the indirect effect of probable diagnosis on alcohol misuse via distress tolerance being stronger among males than females. Gender did not moderate the mediating effect for the relationship between probable depression and AUDIT scores. (See Table 4).

4. DISCUSSION

This study examined the relationship between two mental health problems common in young adult U.S. military veterans – depression and PTSD – with problem drinking. Results demonstrated a strong correlation between both probable PTSD and depression with problem drinking, which has been noted by prior studies in VA and community samples (Burnett-Zeigler et al., 2011; Jakupcak et al., 2010). Distress tolerance was a significant mediating factor for both probable PTSD and depression, as well as probable comorbid PTSD and depression. This supports our hypothesis that distress tolerance may serve as a transdiagnostic mechanism in that it accounted for comorbidity of *both* PTSD and depression with alcohol problems, as well as the tri-morbidity among all three concerns. As has been proposed in other work, drinking may serve an avoidance or numbing functioning for those with mental health problems like PTSD and depression, which for veterans specifically, can lead to a problematic reciprocal loop by which one drinks to reduce mental health symptoms but drinking then exacerbates these symptoms (Brady et al., 2004; Jakupcak et al., 2010; Schumm and Chard, 2012). Low distress tolerance may be a mechanism by which this process occurs, such that those who cannot manage distress are more likely to drink alcohol to cope with distressing PTSD and/or depression symptoms and also experience more psychopathology due to the absence of long-term adaptive coping strategies for distress. Building one's distress tolerance skills, in addition to targeting symptoms of PTSD and/or depression among heavy drinkers therefore may be an appropriate target for interventions. Interventions that explicitly address distress tolerance, such as Dialectical Behavior Therapy (DBT), may be one option, especially as DBT has been adapted for individuals with PTSD (Becker and Zayfert, 2001; Wagner and Linehan, 2006) and depression (Harley et al., 2008).

The reverse and alternative mediation models showed evidence of statistical mediation in multiple configurations of interrelations between mental health, distress tolerance, and alcohol problems as the regressor, mediator, and outcome. This finding suggests that alternative pathways linking PTSD/depression, alcohol problems, and distress tolerance are possible and cannot be ruled out in the current design – including the possibility that distress tolerance is a transdiagnostic mechanism in multiple patterns of comorbidity in which PTSD/depression precedes alcohol problems, as well as alcohol problems preceding PTSD/depression. It will be important for future studies to examine the directionality of these variables using a longitudinal design.

Gender emerged as a moderator of the mediating effect for PTSD and for those screening positive for both depression and PTSD, with the indirect effect via distress tolerance emerging as stronger for males than females. This is particularly interesting in the context of the mixed results of previous studies that have examined the moderating effect of gender (Ali et al., 2015; Tull et al., 2012; Wolitzky-Taylor et al., 2015). Because so few studies have tested for moderated mediation, it will be important for future studies to also examine gender as a moderator within a veteran sample to determine if this effect is replicated. However, if the effect is truly stronger among male veterans, it will be important to explore other variables that may have a stronger mediating effect among females (e.g., anxiety sensitivity; Wolitzky-Taylor et al., 2015) to better inform gender-specific interventions. It should also be considered whether male veterans may particularly benefit from approaches that build distress tolerance skills, potentially as a precursor to other evidence-based treatments (e.g., prolonged exposure, cognitive processing therapy) (Becker and Zayfert, 2001). Finally, future research may elucidate the reasons for this gender difference, for instance, by examining the nature of the index trauma (e.g., combat trauma, military sexual trauma, some other trauma).

It is important not to overlook that gender was not a significant moderator when examining probable depression. This is somewhat surprising, particularly in the context of studies that have found depression to be more prevalent among female veterans (Haskell et al., 2010; Maguen et al., 2010); however, it may be that the relatively smaller proportion of female veterans in the present sample accounts for the lack of moderating effect. Therefore, despite our recruitment strategy, which obtained a comparable proportion of female veterans to male veterans as would be expected in the veteran population, it would be useful to further examine this question with a sample that includes a more balanced proportion of female veterans. With that said, it is also possible that distress tolerance plays a similar transdiagnostic role in the relationship between depression and alcohol misuse for both males and females. For instance, by promoting avoidance behavior, low distress tolerance may lead to social withdrawal in cases where social situations may be distressing, thereby promoting loneliness, avoidance, and diminished self-worth. In turn, low distress tolerance may impact treatment outcomes – and in fact, there is evidence that individuals entering depression treatment who have lower distress tolerance report higher depressive symptoms both before and after a depression-focused intervention (Williams et al., 2013). Therefore, promoting distress tolerance skills may strengthen the effectiveness of depression interventions for individuals who are particularly distress intolerant.

This study has certain limitations. Because these analyses are based on cross-sectional data, no inferences regarding causality can be made. In the future, it will be important to examine the temporal interplay among these factors. In addition, because of the nature of this survey, these analyses are based on self-report measures of mental health and alcohol misuse rather than interview-based measures, and thus do not represent diagnosed conditions. Relatedly, although the instructions preceding the PCL-5 prompted participants to consider a specific traumatic event when completing the measure, we did not collect information about the nature of the index trauma, which limited our ability to examine whether these effects hold across various types of trauma. In addition, the sample predominantly comprised white veterans, and therefore results may not completely generalize to veterans from racial/ethnic

minority groups. Finally, although we used participant responses about military service to evaluate the validity of their veteran status – an approach that been successful in our prior work (Pedersen et al., 2015a) – it was not possible to verify with certainty that all participants were military veterans.

It is also important to acknowledge that by using clinically-informed cutpoints for study variables, it is possible that clinically-relevant variability above and below the cutoff scores may be overlooked, and integration with dimensional conceptualizations of psychopathology (e.g., the National Institutes of Health Research Domain Criteria [RDoC] initiative; Insel and Cuthbert, 2015) may be difficult. Nonetheless, the use of cutoffs and diagnostic categories remains the norm in clinical practice settings for a number of reasons; for instance, (1) in part to accommodate system-level factors such as insurance billing and reimbursement, as at many hospitals that treat military veterans and other populations in high volumes, and (2) for efficient identification of patients in primary care and other general medical settings that are appropriate for referral to more comprehensive evaluations or to specialty treatment clinics (e.g., trauma recovery or chemical dependency programs; Cano et al., 2001; SAMHSA-HRSA Center for Integrated Health Solutions, n.d.). Therefore, the results generated herein are of high clinical utility and may be readily generalizable to health services settings, despite certain limitations.

Despite these limitations, this study also has considerable strengths. Many studies of mental health and alcohol misuse in veterans rely on samples of veterans who are seeking treatment through the VA. In contrast, we were able to capture a broader sample of veterans, including those who may not be seeking treatment, as only 7% of our sample sought alcohol treatment in the past year and nearly one-third had never sought care at a VA for any reason since separation from the military. We also recruited a sample with nearly 17% female veterans, which closely matches the percentage of female OEF/OIF veterans in the community, and expands on studies recruiting from the VA population where women veterans may be underrepresented (Friedman et al., 2011; U.S. Department of Veterans Affairs, 2015). Finally, we were able to focus on a subset of young veterans who may be particularly at risk for problem drinking behavior, and for whom a better understanding of treatment targets is critical.

4.1 Conclusions

This is the first study to examine the role of distress tolerance in the relationship between mental health and alcohol misuse in a U.S. military veteran population. These results suggest that distress tolerance plays a role in the relationship between common postdeployment mental health concerns and alcohol misuse in young adult veterans. Given the significant health and psychosocial consequences of depression, PTSD, problem drinking, and the potential for tri-morbidity of these three conditions among young veterans and other high-risk populations, additional investigation of transdiagnostic factors that underlie these comorbidities is warranted and may be essential to informing prevention and treatment efforts.

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Highlights

- Mental health symptoms co-occur with alcohol misuse in young adult veterans
- Distress tolerance mediates the association of mental health and alcohol misuse
- The mediating effect of distress tolerance is stronger among male veterans
- Distress tolerance may be a transdiagnostic factor underlying this comorbidity

Table 1

Demographic characteristics.

	<u>% (n)</u>
Gender	
Male	83.3% (652)
Female	16.7% (131)
Ethnicity	
Non-Hispanic	89.5% (701)
Hispanic	10.5% (82)
Race	
White	84.8% (664)
Black	4.1% (32)
Other [†]	11.1% (87)
Branch of Service	
Army	59.8% (468)
Navy	8.7% (68)
Air Force	9.7% (76)
Marine Corps	21.8% (171)
Marital Status	
Married	48.7% (381)
Engaged/Cohabiting	14.3% (112)
Divorced/Separated	19.7% (154)
Single	15.8% (124)
Widowed	0.4% (3)
Other	1.1% (9)
Educational Background	
Some high school/high school diploma/GED	20.4% (160)
Some college	59.3% (464)
College degree or higher	20.3% (159)
Employment Status	
Employed full time	54.3% (425)
Employed part time	11.5% (90)
Unemployed	34.2% (268)
Annual Income	
<\$25,000	29.1% (228)
\$25,000–\$49,999	39.2% (307)
>\$50,000	31.7% (248)

[†] Category includes Asian (n = 8), Native Hawaiian/Pacific Islander (n = 3), American Indian/Alaska Native (n = 19), multiracial (n = 45), and other (n = 12)

Table 2

Bivariate correlations among primary variables for the full sample and by gender

	Full Sample				
	Probable Depression	Probable PTSD	Probable Depression + PTSD	DTS	AUDIT
Probable Depression	--	0.67**	0.78**	-0.39**	0.38**
Probable PTSD		--	0.90**	-0.41**	0.37**
Probable Depression + PTSD			--	-0.39**	0.36**
DTS				--	-0.23**
AUDIT					--

	By Gender (Females on Top Half, Males on Bottom Half)				
	Probable Depression	Probable PTSD	Probable Depression + PTSD	DTS	AUDIT
Probable Depression	--	0.60**	0.74**	-0.30**	0.39**
Probable PTSD	0.68**	--	0.88**	-0.28**	0.22*
Probable Depression + PTSD	0.79**	0.91**	--	-0.24**	0.27**
DTS	-0.41**	-0.44**	-0.42**	--	-0.29**
AUDIT	0.39**	0.41**	0.38**	-0.25**	--

*
p < .05,

**
p < .01

DTS = Distress Tolerance Scale, AUDIT = Alcohol Use Disorders Identification Test

Table 3

Models Examining the Mediating Effect of Distress Tolerance

	Total Effect			Direct Effect			Indirect Effect [†]			Ratio of Indirect to Total Effect		
	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI
Probable depression	5.41	0.46	[4.51–6.32]	4.76	0.50	[3.78–5.73]	0.66	0.21	[0.27–1.10]	0.12	0.04	[0.05–0.21]
Probable PTSD	5.29	0.47	[4.36–6.22]	4.58	0.52	[3.57–5.59]	0.71	0.23	[0.28–1.18]	0.13	0.05	[0.05–0.24]
Probable PTSD and depression	5.21	0.49	[4.25–6.17]	4.45	0.53	[3.42–5.48]	0.76	0.23	[0.33–1.23]	0.15	0.05	[0.06–0.25]

DTS = Distress Tolerance Scale

[†]Via DTS scores

Table 4
Gender as a Moderator of the Mediated Effect of Mental Health on Alcohol Problems through Distress Tolerance

	Direct Effect B [95% CI]	Interaction Term for Direct Effect B [95% CI]	Indirect Effect B [95% CI]	Index of Moderated Mediation B [95% CI]
Probable Depression				
Male	4.80 [3.74, 5.86] [*]	-0.23 [-2.63, 2.17]	0.69 [0.29, 1.15] [*]	-0.22 [-0.65, 0.05]
Female	4.56 [2.36, 6.77] [*]		0.47 [0.16, 0.95] [*]	
Probable PTSD				
Male	5.07 [3.97, 6.17] [*]	-2.70 [-5.16, -0.25] [*]	0.73 [0.28, 1.25] [*]	-0.30 [-0.78, -0.04] [*]
Female	2.36 [0.12, 4.61] [*]		0.43 [0.13, 0.90] [*]	
Probable PTSD and Depression				
Male	4.75 [3.62, 5.88] [*]	-1.67 [-4.22, 0.88]	0.81 [0.36, 1.32] [*]	-0.41 [-0.95, -0.09] [*]
Female	3.08 [0.75, 5.41] [*]		0.40 [0.10, 0.88] [*]	

Note: In each model, DTS is the mediator. AUDIT is the outcome. The interaction term for the direct effect provides a test of moderation of the direct effect, while the index of moderated mediation provides a test of moderation of the indirect effect.

^{*} p < .05