Posttraumatic stress, alcohol use, and alcohol use motives among firefighters: The role of distress tolerance

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ABSTRACT

Firefighters represent a unique, vulnerable population at high risk for alcohol use disorder (AUD) and posttraumatic stress disorder (PTSD) symptomatology due to the high rates of occupational exposure to traumatic events. To inform specialized alcohol use interventions for firefighters, it is important to understand relevant malleable cognitive-affective factors related to PTSD and AUD symptoms. Distress tolerance (DT), defined as the perceived ability to withstand negative emotional states, is one promising factor relevant to this domain. The current study examined the moderating role of DT in the association of PTSD symptom severity with alcohol use severity and alcohol use motives. Participants included 652 trauma-exposed firefighters (93.3% male; M_{age} = 38.7 years, SD = 8.6) who endorsed lifetime (ever) alcohol use. Results indicated that there was a significant interactive effect of PTSD symptom severity and DT on coping-oriented alcohol use motives but not other alcohol-related outcomes. These findings were evident after adjusting for alcohol consumption, romantic relationship status, number of years in the fire service, occupational stress, and trauma load. This is the first study to concurrently examine these variables among firefighters and this line of inquiry has great potential to inform intervention efforts for this vulnerable, understudied population.

1. Introduction

Higher rates of alcohol use and related disorders have been documented among firefighters compared to the general population (e.g., Grant et al., 2015; Haddock et al., 2015; Meyer et al., 2012; Smith et al., 2018; Tomaka et al., 2017). It is estimated that approximately 50% of firefighters engage in heavy drinking (Haddock et al., 2015) and 58% demonstrate binge drinking behavior (Carey et al., 2011). Extant research has demonstrated a 47% lifetime prevalence of alcohol use disorder (AUD) among firefighters (North et al., 2002), compared to a lifetime prevalence of 29.1% of AUD among the general population (Grant et al., 2015). An emergent literature suggests that firefighters report consuming alcohol in an effort to cope with negative emotional states (Bacharach et al., 2008; North et al., 2002; Tomaka et al., 2017). Coping-oriented alcohol use among firefighters has been associated with more severe alcohol use (Meyer et al., 2012; Smith et al., 2018; Tomaka et al., 2017) and greater levels of work-related stress (Bacharach et al., 2008). Firefighters experience unique, job-related stressors (e.g., exposure to potentially traumatic events and atypical work hours) which may influence drinking patterns (Haddock et al., 2012; Jones, 2017).

Indeed, firefighters are at significantly elevated risk for exposure to traumatic events and posttraumatic stress disorder (PTSD), both significant risk and maintenance factors for AUD. Trauma exposure among firefighters has been estimated to be 91.5% (Meyer et al., 2012), and prevalence rates of PTSD among firefighters have been estimated to be as high as 33% in some studies (Tomaka et al., 2017), although epidemiological studies are lacking. Greater PTSD symptomatology has been correlated with increased at-risk drinking and greater alcohol-related problems among firefighters (Tomaka et al., 2017). Firefighters with greater PTSD symptomatology consume a greater number of alcoholic drinks per week (Gulliver et al., 2018), even after controlling for trauma exposure and depression symptoms.

Motivational models of alcohol use broadly define coping and conformity as avoidant motives (Cooper et al., 1995, 2016; Cox and Klinger, 1988). PTSD symptom severity among firefighters has been associated with coping motives for alcohol use (Meyer et al., 2012; Smith et al., 2018; Tomaka et al., 2017). Recent findings demonstrate that coping-oriented alcohol use mediates the association between PTSD symptoms and problematic alcohol use (Tomaka et al., 2017). Unlike coping-motivated alcohol use, associations between PTSD symptomatology and *conformity*-motivated alcohol use are

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inconsistently documented in the literature. Among firefighters, there is a positive association between PTSD symptom severity and conformity motives (Smith et al., 2018; Tomaka et al., 2017). Among military veterans who report heavy drinking, this association was significant only for those who did *not* meet criteria for PTSD (McDevitt-Murphy et al., 2015). Conversely, no such association has been documented among community samples of trauma-exposed adults, where PTSD symptom severity was measured via semi-structured interview (Vujanovic et al., 2011). These discrepancies may be a result of population differences or PTSD measurement differences. Given the high prevalence of both PTSD symptoms and alcohol use among firefighters, it is important to advance understanding of factors that may influence this comorbidity so as to inform specialized, evidence-based intervention efforts.

Distress tolerance (DT), or the ability to withstand negative physical or emotional states (Leyro et al., 2010), is one transdiagnostic factor with clinical relevance to both PTSD symptoms and alcohol use. Distress tolerance has been inversely associated with PTSD symptom severity among samples of adults exposed to various potentially traumatic events, including firefighters (Banducci et al., 2017; Bartlett et al., 2018; Hashoul-Andary et al., 2016; Vujanovic et al., 2011, 2017). Among individuals with PTSD, preliminary research has demonstrated that increases in distress tolerance are related to improvements in PTSD symptomatology during the course of treatment (Banducci et al., 2017). Research has also demonstrated that distress tolerance is negatively correlated with alcohol use and alcohol use coping motives (Duranceau et al., 2014; Holliday et al., 2016; Marshall-Berenz et al., 2011; Vujanovic et al., 2011).

Across various populations, distress tolerance has demonstrated an influence on the association between PTSD and alcohol use as well as coping-motivated alcohol use (Duranceau et al., 2014; Haller and Chassin, 2014; Marshall-Berenz et al., 2011; Vinci et al., 2016; Vujanovic et al., 2011). Within trauma-exposed samples, lower distress tolerance has been associated with increased alcohol use (Duranceau et al., 2014; Haller and Chassin, 2014; Vinci et al., 2016). Distress tolerance has also been shown to significantly mediate the effect of PTSD symptoms on alcohol use severity (Duranceau et al., 2014; Holliday et al., 2016) and alcohol-related coping motives (Marshall-Berenz et al., 2011; Vujanovic et al., 2011). Notably, the literature on distress tolerance and alcohol motives is relatively nascent and mixed, yielding inconsistent associations between distress tolerance and motivations for alcohol use (e.g., Marshall-Berenz et al., 2011; Williams et al., 2015).

Among firefighters with PTSD, it is theorized that those with lower distress tolerance may have a greater risk of using alcohol to cope when confronted with trauma-related cues or PTSD symptoms (Haller and Chassin, 2014; Meyer et al., 2012; Smith et al., 2018; Tomaka et al., 2017). Thus, firefighters experiencing PTSD symptomatology may be more likely to consume greater amounts of alcohol and to do so as a maladaptive way to cope with negative emotions (Bacharach et al., 2008). A lower perceived ability to tolerate negative emotions may therefore exacerbate the established association between PTSD symptom severity and a) greater alcohol use and b) greater coping-oriented alcohol use among firefighters (Duranceau et al., 2014; Haller and Chassin, 2014; Holliday et al., 2016; Marshall-Berenz et al., 2011; Vinci et al., 2016; Vujanovic et al., 2011). This model is consistent with the self-medication model of PTSD/AUD comorbidity (e.g., Haller and Chassin, 2014; Khantzian, 1997; Sheerin et al., 2016; Stewart et al., 1998; Ullman et al., 2005), which posits that alcohol use may be used to manage (i.e., decrease), albeit acutely, PTSD symptoms.

Extant empirical literature with regard to distress tolerance among firefighters is at a nascent stage of development. We are aware of only three published studies that have examined distress tolerance, broadly, in this vulnerable population (Bartlett et al., 2018; Smith et al., 2018; Stanley et al., 2018). None of these studies has examined the role of distress tolerance in the association between PTSD symptomatology and alcohol use or alcohol use motives. This is an important gap in the

firefighter literature, given the unique occupational demands, chronic stressors, and trauma exposure inherent to the profession, as well as the high rates of alcohol use (Haddock et al., 2012; Jones, 2017; Meyer et al., 2012; Smith et al., 2018; Tomaka et al., 2017). Furthermore, given barriers to mental health treatment in the fire service, including stigma (Haugen et al., 2017), advancing clinically relevant knowledge with potential to inform specialized treatment development is imperative.

Therefore, the current study aimed to examine associations between PTSD symptoms, distress tolerance, and alcohol use severity as well as alcohol use motives (i.e. coping, enhancement, conformity, and social) among firefighters. First, we hypothesized that firefighters with greater PTSD symptom severity would report greater alcohol use and alcohol use coping motives. Second, we hypothesized that those with lower levels of perceived distress tolerance would report greater alcohol use and alcohol use coping motives. Finally, we hypothesized that perceived distress tolerance would moderate the association of PTSD symptom severity with alcohol use severity and alcohol use coping motives. That is, we expected the strongest relationship between elevated PTSD symptoms and greater alcohol use and alcohol use coping motives to be observed among firefighters with low levels of perceived distress tolerance. Consistent with past literature among firefighters (Bacharach et al., 2008; Smith et al., 2018), no significant effects were expected for alcohol use motives other than coping motives (i.e., enhancement, conformity, social). All associations were predicted above and beyond theoretically-relevant covariates, including romantic relationship status, years of service in the fire department, occupational stress, and trauma load (i.e., total number of traumatic event types experienced). Covariates were selected based upon their significant associations with PTSD symptomatology and alcohol use severity in extant research among firefighters (Bartlett et al., 2018; Meyer et al., 2012; Piazza-Gardner et al., 2014; Smith et al., 2018, 2018; Stanley et al., 2018). To control for the effect of alcohol use severity on use motives, alcohol consumption was included as a covariate for all analyses examining motives.

2. Methods

2.1. Participants

This study is a secondary analysis of data from a larger project examining stress and health-related behaviors among firefighters. Participants included 652 professional firefighters (93.3% male; M_{age} = 38.7, SD = 8.6) from a fire department in a large metropolitan area in the southern U.S. Please see Table 1 for a summary of the sociodemographic characteristics of this sample. All firefighters in this department provide Emergency Medical Services (EMS) in addition to fire suppression. Study inclusion criteria required participants to be over 18 years of age, be current firefighters, and have consented to completion of all online questionnaires. Exclusionary criteria included inability or unwillingness to consent to complete the online questionnaires. To be included in the current analyses, participants must have experienced at least one PTSD Criterion A traumatic life event (American Psychiatric Association, 2013) and endorsed lifetime alcohol consumption.

2.2. Measures

2.2.1. Demographic questionnaire

Participants were asked to self-report demographic information including sociodemographic characteristics and firefighter service history.

2.2.2. Sources of occupational stress-14 (SOOS-14; Kimbrel et al., 2011)

The SOOS-14 is an abbreviated version of the Sources of Occupational Stress Scale (Beaton and Murphy, 1993) designed to

Table 1
Participant sociodemographic characteristics.

	Mean	SD
Age	38.72	8.57
Years in fire service	13.39	8.81
Trauma load	11.57	3.78
	n	**Valid%**
Gender		
Male	608	93.25
Female	39	5.98
Transgender	5	0.77
Race		
White	507	77.76
Black or African American	71	10.89
Other	50	7.67
American Indian or Alaskan Native	12	1.84
Asian	11	1.69
Native Hawaiian or other Pacific Islander	1	0.15
Ethnicity		
Hispanic or Latinx	169	25.92
Not Hispanic or Latinx	483	74.08
Marital Status		
Married	441	67.64
Single	123	18.87
Divorced	50	7.67
Living with partner	36	5.52
Widowed	2	0.30
Education		
8th Grade	2	0.31
Partial completion of high school or GED equivalent	293	44.94
High school graduate	303	46.47
Partial completion of college	53	8.13
College graduate	1	0.15
Trauma Exposure		
Transportation accident	635	97.39
Fire or explosion	627	96.17
Natural disaster	618	94.79
Serious accident at work, home, or during recreational activity	563	86.35
Sudden violent death	545	83.59
Sudden accidental death	537	82.36
Physical assault	535	82.06
Exposure to toxic substance	520	79.75
Assault with a weapon	485	74.39
Any other very stressful event or experience	481	73.77
Severe human suffering	449	68.87
Life-threatening illness or injury	442	67.79
Sexual assault	383	58.74
Other unwanted or uncomfortable sexual experience	281	43.10
Serious injury, harm, or death you caused to someone else	229	35.12
Combat or exposure to a war-zone	117	17.94
Captivity	94	14.42
Meeting criteria for:		
Probable AUD diagnosis[a]	150	23.00
Probable PTSD diagnosis[b]	62	9.51

Note. N = =652; SD = standard deviation;.
[a] Probable AUD diagnosis was considered a score of 8 or greater on the AUDIT (Saunders et al., 1993).
[b] Probable PTSD diagnosis was considered a score of 33 or greater on the PCL-5 (Blevins et al., 2015).

measure job-related stress for firefighters (e.g. financial strain due to inadequate pay, disruption of sleep, feelings of isolation from family due to work demands and stress). Respondents are asked to rate each of the 14 items on a 5-point Likert scale (1 = *Not at all bothered* to 5 = *Extremely bothered)*, with higher scores indicating greater occupational stress. The SOOS-14 has demonstrated good psychometric properties (Kimbrel et al., 2015). In the current study, the internal consistency for the SOOS-14 total score was excellent ($\alpha = 0.90$).

2.2.3. Life events checklist version-5 (LEC-5; Weathers et al., 2013)

The LEC-5 is a self-report questionnaire used to screen for potentially traumatic events experienced at any time throughout the lifespan. Respondents are provided a list of 16 potentially traumatic events (e.g.,

combat, sexual assault, transportation accident) as well as an additional item assessing for 'other' potentially traumatic events not listed. Respondents are asked to indicate (via check mark) whether each listed event "happened to me", "witnessed it", "learned about it", "part of my job", or "not sure". If participants endorsed that an event "happened to me", "witnessed it", or "part of my job", this was coded as positive exposure to that particular type of traumatic event. Total exposures were summed to produce a 'trauma load' variable indicating the total number of traumatic life event types experienced.

2.2.4. PTSD checklist for DSM-5 (PCL-5; Blevins et al., 2015)

Respondents were asked to complete the PCL-5 with regard to the "worst" traumatic event endorsed on the LEC-5. The PCL-5 is a 20-item self-report questionnaire that measures PTSD symptom severity over the past month. Each of the 20 items reflects a symptom of PTSD according to *DSM-5* criteria (American Psychiatric Association, 2013). Participants are asked to rate each item on a 5-point scale (0 = *Not at all* to 4 = *Extremely*) to indicate how much they have been bothered by the symptom in the past month. Total symptom severity scores range from 0 to 80, with higher scores indicating greater symptom severity. A score of 33 or greater is the suggested cut-off for a probable diagnosis of PTSD (e.g., Bovin et al., 2016). The PCL-5 has demonstrated good psychometric properties (Blevins et al., 2015). Internal consistency was excellent for the PCL-5 total score in the present study ($\alpha = 0.97$). The total score for the PCL-5 was used as the predictor variable in the present study.

2.2.5. Distress tolerance scale (DTS; Simons and Gaher, 2005)

The DTS is a 15-item self-report measure that evaluates the extent to which respondents believe they can experience and withstand distressing emotional states, rated on a 5-point scale (1 = *strongly agree* to 5 = *strongly disagree*). Total scores range from 15 to 75, with higher values indicating greater levels of distress tolerance (i.e. greater perceived ability to withstand distress). The DTS demonstrates good psychometric properties, including good internal consistency, test–retest reliability, convergent validity, and discriminant validity with established measures of mood (Simons and Gaher, 2005). For the current study, the DTS total score was used to represent the overall level of distress tolerance, as consistent with past literature (Simons and Gaher, 2005; Vujanovic et al., 2013). In the present study, internal consistency for the DTS total score was excellent ($\alpha = 0.92$). For the purposes of this study, the DTS total score was used as a predictor and moderator variable.

2.2.6. Alcohol use disorders identification test (AUDIT; Saunders et al., 1993)

The AUDIT is an extensively validated 10-item, Likert-style screening instrument designed to identify individuals presenting with alcohol problems (Newcombe et al., 2005; Saunders et al., 1993). Scores range from 0 to 40, and the generally accepted cut-off to identify potentially hazardous drinking is 8 or greater (Saunders et al., 1993). Severity of alcohol consumption is measured by the sum total of the first three items (Saunders et al., 1993). The AUDIT has demonstrated good test-retest reliability (Selin, 2003) and validity (Bohn et al., 1995). The AUDIT has demonstrated high sensitivity and specificity for detecting probable alcohol dependence and hazardous or harmful drinking (Barry and Fleming, 1993; Saunders et al., 1993; Schmidt et al., 1995). The internal consistency was good for the AUDIT total score ($\alpha = 0.85$) and acceptable for the AUDIT consumption score ($\alpha = 0.73$) in the present study. For the current study, the AUDIT total score was used as an outcome in analyses.

2.2.7. Drinking motives questionnaire revised short form (DMQ-R-SF; Kuntsche and Kuntsche, 2009)

The DMQ-R-SF is a 12-item self-report measure designed to assess reasons for consuming alcohol. The DMQ-R-SF measures the frequency

with which individuals consume alcohol, separated by motivation into four categories: Coping (i.e., drinking to cope with negative emotions), Enhancement (i.e., drinking to enhance positive mood or well-being), Conformity (i.e., drinking to conform or avoid social censure and rejection), and Social (i.e., drinking to obtain positive social rewards). Each subscale consists of three items summed to produce scores ranging from 3 to 9. This instrument has been validated across international samples (Kuntsche and Kuntsche, 2009; Mazzardis et al., 2010; Nemeth et al., 2011). The internal consistency was excellent for the DMQ-R-SF social subscale ($\alpha = 0.92$), good for the conformity subscale ($\alpha = 0.86$), good for the coping subscale ($\alpha = 0.85$), and acceptable for the enhancement subscale ($\alpha = 0.70$). The DMQ-R-SF subscales were used as outcomes in analyses for the present study.

2.3. Procedure

Firefighters were recruited for participation in the parent study through a fire department-wide e-mail. This email informed firefighters of the opportunity to complete an online research survey for one continuing education (CE) credit and a chance to win one of several raffle prizes (e.g., restaurant gift cards, movie theater tickets). After reviewing a description of the survey and the informed consent form, those who did not wish to participate or consent to the study were given the option to decline by clicking 'no'. Once those who were interested in taking part (by clicking 'yes') electronically signed the consent form, they were directed to the survey. All firefighters who considered participating in the survey (and confirmed consideration by clicking 'yes' or 'no') received one CE credit. While 2060 firefighters reviewed the informed consent form, a subset of 1236 consented to participation. Of the 1236 who consented to participate, 681 completed all measures of interest for the present analysis. Of these 681 participants, two were removed for reporting no lifetime alcohol use and 27 were removed for not reporting exposure to any lifetime traumatic event. The amount of time required to participate in the full survey was estimated to be between 45–60 min. Firefighters had the option to discontinue participation at any time without penalty. The study was approved by all relevant institutional review boards.

2.4. Data analytic strategy

All analyses were conducted using IBM SPSS version 25.0. First, descriptive statistics and zero-order correlations among study variables were examined (see Table 2). Then, a series of five hierarchical

regression analyses was conducted. Covariates in step one included romantic relationship status, number of years in the fire service, occupational stress, and trauma load. Alcohol consumption was entered as an additional covariate for analyses examining the DMQ-R-SF subscales as outcomes. In the second step, PTSD symptom severity (PCL-5 total score) and distress tolerance (DTS total score) were entered. At step three, the interactive effect of PTSD symptom severity (PCL-5 total score) by distress tolerance (DTS total score) was entered.

The main and interactive effects of PTSD symptom severity (PCL-5 total score) and distress tolerance (DTS total score) were evaluated with regard to five alcohol-related outcomes: (1) alcohol use severity (AUDIT total score), (2) alcohol use coping motives (DMQ-R-SF: Coping subscale), (3) alcohol use conformity motives (DMQ-R-SF: Conformity subscale), (4) alcohol use social motives (DMQ-R-SF: Social subscale), and (5) alcohol use enhancement motives (DMQ-R-SF: Enhancement subscale). All continuous variables were mean-centered (Hoffman and Gavin, 1998). A Bonferroni correction (alpha = 0.05/5 = 0.01) was applied to control for Type I error rate. Simple slope post-hoc analyses to probe significant interactions were conducted to determine the strength of the association between the predictor variable and criterion variables at different levels of the moderator (Bauer and Curran, 2005; Preacher et al., 2006; Spiller et al., 2013).

3. Results

3.1. Bivariate correlations

Descriptive statistics and zero-order correlations among study variables are presented in Table 2. PTSD symptom severity was negatively associated with distress tolerance, positively associated with alcohol use severity, and positively associated with all four drinking motives. Distress tolerance was negatively associated with alcohol use severity and the four drinking motives.

3.2. Main analyses

Please see Table 3 for a summary of main analyses. Regarding alcohol use severity, the first step was significant and accounted for 9% of variance and romantic relationship status and occupational stress emerged as significant predictors. In step two, statistically significant main effects emerged for PTSD symptom severity and distress tolerance, accounting for an additional 8% of unique variance. In step three, the interactive effect was not statistically significant.

Table 2
Descriptive statistics and bivariate correlations of study variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Romantic Relationship [a]	–											
2. Years in the fire service [a]	.21**	–										
3. Occupational Stress (SOOS-14 Total) [a]	0.04	0.06	–									
4. Trauma load (LEC-5 Total) [a]	0.06	0.04	.18**	–								
5. Alcohol consumption[a] (AUDIT Hazardous subscale)	−0.08*	−0.01	.20**	0.09*	–							
6. PTSD symptom severity (PCL-5 Total) [b]	−0.05	0.02	.63**	.12**	.23**	–						
7. Distress tolerance (DTS Total) [d]	0.04	0.02	−0.22**	0.00	−0.13**	−0.36**	–					
8. Alcohol use severity (AUDIT Total) [c]	−0.09*	−0.03	.28**	.10**	.81**	.40**	−0.21**	–				
9. Enhancement drinking motives [c] (DMQ-R-SF Enhancement subscale)	−0.11**	−0.12**	.24**	0.09*	.54**	.25**	−0.08*	.51**	–			
10. Social drinking motives [c] (DMQ-R-SF Social subscale)	−0.09*	−0.12**	.23**	0.08	.45**	.22**	−0.10*	.42**	.74**	–		
11. Conformity drinking motives [c] (DMQ-R-SF Conformity subscale)	−0.01	−0.03	.22**	.12**	.21**	.31**	−0.22**	.35**	.37**	.40**	–	
12. Coping drinking motives [c] (DMQ-R-SF Coping subscale)	−0.05	−0.03	.36**	0.07	.44**	.51**	−0.32**	.54**	.54**	.46**	.51**	–
Mean/*n*	477	13.39	25.52	11.57	3.97	10.37	61.76	5.55	4.55	4.94	3.40	3.79
Standard Deviation/%	73.2	8.81	9.93	3.78	2.36	14.08	12.14	5.04	1.47	1.81	1.00	1.39

Note. N = =652; ** $p < 0.01$; * $p < 0.05$; [a] Covariate. [b] Predictor. [c] Outcome. [d] Moderator. Romantic Relationship = % listed as currently in a romantic relationship (Coded: 0 = No [single, divorced, widowed], 1 = Yes [married, living with partner]); AUDIT = Alcohol Use Disorders Identification Test (Saunders et al., 1993); DMQ-R-SF = Drinking Motives Questionnaire Revised Short Form (Kuntsche and Kuntsche, 2009); DTS = Distress Tolerance Scale (Simons and Gaher, 2005); LEC-5 = Life Events Checklist for DSM-5 (Weathers et al., 2013); PCL-5 = Posttraumatic Disorder Checklist for DSM-5 (Blevins et al., 2015); SOOS-14 = Sources of Occupational Stress (Kimbrel et al., 2011).

Table 3

Main and interactive effect of PTSD symptom severity and distress tolerance in relation to alcohol use severity and motives.

Alcohol use severity	B	SE	t	p	95% CI		R^2 or ΔR^2
Step 1							
Romantic relationship status	−1.135	0.436	−2.605	0.009	−1.990	−0.279	
Years in the fire service	−0.017	0.022	−0.780	0.436	−0.060	0.026	
Occupational stress	0.139	0.019	7.192	0.000	0.101	0.177	
Trauma load	0.077	0.051	1.521	0.129	−0.022	0.177	.092
Step 2							
PTSD symptom severity	0.119	0.017	6.852	0.000	0.085	0.153	
Distress tolerance	−0.034	0.016	−2.149	0.032	−0.065	−0.003	.083
Step 3							
PTSD symptom severity x Distress tolerance	−0.001	0.001	−1.283	0.200	−0.003	0.001	.002
Enhancement motives	**B**	**SE**	**t**	**p**	**95% CI**	**R^2 or ΔR^2**	
Step 1							
Romantic relationship status	−0.165	0.110	−1.502	0.134	−0.380	0.051	
Years in the fire service	−0.019	0.006	−3.499	0.000	−0.030	−0.008	
Occupational stress	0.022	0.005	4.375	0.000	0.012	0.031	
Trauma load	0.011	0.013	0.877	0.381	−0.014	0.036	
Alcohol consumption	0.311	0.021	15.078	0.000	0.270	0.351	.325
Step 2							
PTSD symptom severity	0.008	0.005	1.735	0.083	−0.001	0.017	
Distress tolerance	0.004	0.004	1.071	0.285	−0.004	0.013	.004
Step 3							
PTSD symptom severity x Distress tolerance	0.000	0.000	−0.305	0.760	−0.001	0.000	.000
Social motives	**B**	**SE**	**t**	**p**	**95% CI**	**R^2 or ΔR^2**	
Step 1							
Romantic relationship status	−0.159	0.144	−1.110	0.267	−0.442	0.123	
Years in the fire service	−0.025	0.007	−3.510	0.000	−0.039	−0.011	
Occupational stress	0.029	0.006	4.427	0.000	0.016	0.041	
Trauma load	0.008	0.017	0.496	0.620	−0.025	0.041	
Alcohol consumption	0.315	0.027	11.653	0.000	0.262	0.368	.240
Step 2							
PTSD symptom severity	0.006	0.006	1.066	0.287	−0.005	0.018	
Distress tolerance	0.001	0.005	0.150	0.881	−0.010	0.012	.001
Step 3							
PTSD symptom severity x Distress tolerance	0.000	0.000	−1.296	0.195	−0.001	0.000	.002
Conformity motives	**B**	**SE**	**t**	**p**	**95% CI**	**R^2 or ΔR^2**	
Step 1							
Romantic relationship status	0.005	0.088	0.057	0.954	−0.167	0.177	
Years in the fire service	−0.005	0.004	−1.236	0.217	−0.014	0.003	
Occupational stress	0.017	0.004	4.370	0.000	0.010	0.025	
Trauma load	0.021	0.010	2.077	0.038	0.001	0.041	
Alcohol consumption	0.073	0.016	4.443	0.000	0.041	0.105	.085
Step 2							
PTSD symptom severity	0.015	0.004	4.278	0.000	0.008	0.022	
Distress tolerance	−0.010	0.003	−3.000	0.003	−0.016	−0.003	.050
Step 3							
PTSD symptom severity x Distress tolerance	0.000	0.000	−0.442	0.659	0.000	0.000	.000
Coping motives	**B**	**SE**	**t**	**p**	**95% CI**	**R^2 or ΔR^2**	
Step 1							
Romantic relationship status	−0.052	0.108	−0.479	0.632	−0.264	0.160	
Years in the fire service	−0.007	0.005	−1.261	0.208	−0.017	0.004	
Occupational stress	0.040	0.005	8.239	0.000	0.031	0.050	
Trauma load	−0.006	0.013	−0.515	0.607	−0.031	0.018	
Alcohol consumption	0.226	0.020	11.134	0.000	0.186	0.266	.272
Step 2							
PTSD symptom severity	0.036	0.004	8.656	0.000	0.028	0.044	
Distress tolerance	−0.016	0.004	−4.256	0.000	−0.024	−0.009	.117
Step 3							
PTSD symptom severity x Distress tolerance	−0.001	0.000	−5.036	0.000	−0.001	−0.001	.023

Note. N = =652. Alcohol use severity = AUDIT (Saunders et al., 1993); Romantic relationship status (Coded: 0 = No [single, divorced, widowed], 1 = Yes [married, living with partner]); Occupational stress = SOOS-14 (Kimbrel et al., 2011); Trauma load = LEC-5 (Weathers et al., 2013); PTSD symptom severity = PCL-5 (Blevins et al., 2015); Distress tolerance = DTS (Simons and Gaher, 2005); Coping motives = DMQ-R-SF Coping subscale (Kuntsche and Kuntsche, 2009); Alcohol consumption = AUDIT Hazardous use subscale (Saunders et al., 1993).

With regard to enhancement motives for alcohol use, the first step was significant and accounted for 33% of variance. Years in the fire service, occupational stress, and alcohol consumption emerged as significant predictors. In step two, no significant main effects emerged. In step three, the interactive effect was not statistically significant.

Regarding socially-motivated alcohol use, the first step was significant and accounted for 24% of variance. Years in the fire service, occupational stress, and alcohol consumption emerged as significant predictors. In step two, no significant main effects emerged. In step

three, the interactive effect was not statistically significant.

With regard to alcohol use conformity motives, the first step was significant and accounted for 9% of variance. Occupational stress, trauma load, and alcohol consumption emerged as significant predictors. In step two, statistically significant main effects emerged for PTSD symptom severity and distress tolerance, accounting for an additional 5% of unique variance. In step three, the interactive effect was not statistically significant.

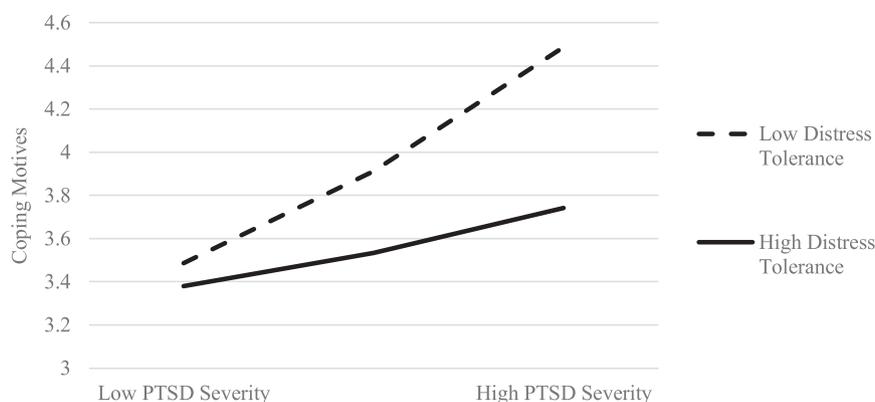Regarding coping-oriented alcohol use, the first step was significant

Fig. 1. Interaction of PTSD symptom severity and distress tolerance predicting coping-motivated alcohol use.

and accounted for 27% of variance, and occupational stress and alcohol consumption emerged as significant predictors. In step two, statistically significant main effects emerged for PTSD symptom severity and distress tolerance, contributing an additional 12% of unique variance to the model. At step three, the interactive effect of PTSD symptom severity and distress tolerance was significant and accounted for an additional 2% variance. Simple slope analyses revealed that PTSD symptom severity was significantly related to coping-motivated alcohol use for firefighters with both low and high levels of distress tolerance, but the magnitude of the effect was strongest for those with lower distress tolerance (see Fig. 1).

4. Discussion

The present study examined the main and interactive effects of PTSD symptom severity and distress tolerance in relation to alcohol use severity and alcohol use motives among a large sample of urban firefighters. PTSD symptom severity was significantly positively associated with alcohol use severity as well as coping motives for alcohol use, after considering covariates. Consistent with hypotheses, firefighters with more severe PTSD symptoms manifested greater alcohol use severity (e.g., Gulliver et al., 2018; Tomaka et al., 2017). Given the cross-sectional nature of findings, it also is possible that increased alcohol use may lead to exposure to traumatic life events given engagement in higher risk behaviors while intoxicated or due to the higher risk lifestyle of an individual with AUD (e.g., Berenz et al., 2019; McCauley et al., 2012).

As predicted, firefighters with greater PTSD symptom severity tend to report higher levels of alcohol use to cope with negative affect. These findings are consistent with the self-medication hypothesis for PTSD/AUD (e.g., Haller and Chassin, 2014; Khantzian, 1997; Sheerin et al., 2016; Stewart et al., 1998), which suggests that those with greater PTSD symptoms have an increased tendency to use alcohol and to do so for purposes of emotion regulation and avoidance of emotional distress (e.g., Erwin et al., 2018; Homish et al., 2019; Ullman et al., 2005). Contrary to expectation, PTSD symptom severity also was positively associated with conformity-motivated alcohol use, suggesting that firefighters with elevated PTSD symptoms may be more likely to use alcohol to avoid social rejection and conform with social groups. Thus, among firefighters in this sample, PTSD symptom severity is associated with avoidance-related alcohol use motives, broadly.

Furthermore, distress tolerance was significantly *negatively* associated with alcohol use severity, conformity motives, and coping motives, above and beyond the effects of covariates. That is, lower levels of distress tolerance were related to higher levels of alcohol use severity as well as alcohol use conformity and coping motives (and vice versa). Consistent with extant research, firefighters with lower levels of distress tolerance demonstrated more severe alcohol use (e.g., Himmerich and Orcutt, 2019; Holliday et al., 2016; Marshall-Berenz et al., 2011). It is

likely that firefighters with a diminished perceived capacity to tolerate distress may consume greater amounts of alcohol in an effort to regulate negative affective states (e.g., Bacharach et al., 2008; Khantzian, 1997). Indeed, lower distress tolerance was also associated with coping and conformity motives for alcohol use, consistent with past work across community samples (e.g., Howell et al., 2010; Vujanovic et al., 2011). Thus, firefighters with lower distress tolerance may tend to engage in greater levels of avoidance-related alcohol use either to avoid negative emotional states (i.e., coping) or avoid social judgment (i.e., conformity). Future research examining the role of alcohol use in firefighter culture, specifically, would be informative in terms of guiding our understanding of firefighters' motivations to use alcohol across contexts.

Hypotheses regarding interactive effects were partially supported by the data. Distress tolerance significantly moderated the association between PTSD symptom severity and coping-oriented alcohol use. These results suggest that firefighters with more severe PTSD symptomatology demonstrate greater tendencies to use alcohol to cope with negative emotional states, and this association is stronger among firefighters with lower levels of distress tolerance (Fig. 1). The interactive effect was significant above and beyond relevant covariates but contributed only 2% of unique variance, and therefore, the clinical significance of this effect warrants additional empirical investigation. This moderation model builds upon extant work, which has documented only the mediating effect of distress tolerance in the association between PTSD and coping-motivated alcohol use among trauma-exposed community samples (Marshall-Berenz et al., 2011; Vujanovic et al., 2011).

These results provide preliminary suggestion that distress tolerance may be a promising clinical factor to explore in future research of PTSD/AUD associations in firefighters. Targeting distress tolerance via skills intervention may have potential to improve outcomes in PTSD/AUD treatments in firefighters, and the dissemination and implementation potential of such interventions is potentially promising. For example, distress tolerance skills interventions for firefighters might be offered via web-based platforms or short-term group or individual formats, pending replication and extension of these findings. Clinically, distress tolerance skills interventions may be helpful as preventive interventions offered in the fire academy or as stand-alone intervention programs for firefighters who may not be ready to engage in treatment, who drop out of evidence-based treatments, or who do not have access to treatments for PTSD, AUD, or PTSD/AUD (e.g., Roberts et al., 2015; Watkins et al., 2018). Alternatively, distress tolerance interventions might be provided as adjunctive treatments prior to or during other evidence-based treatments (e.g., Vujanovic and Zegel, 2019).

Contrary to expectation, distress tolerance did not significantly moderate the association between PTSD symptom severity and alcohol use severity. While past work has shown distress tolerance to mediate the association between PTSD symptom severity and alcohol use

severity, these findings were only demonstrated among a community sample (Duranceau et al., 2014) and a sample of young adult veterans (Holliday et al., 2016). This discrepancy in our findings may be due to factors unique to firefighter samples. For example, underreporting of alcohol use in this sample may have resulted in limited variability, which could explain the absence of an interactive effect. Notably, PTSD symptom severity and distress tolerance were each independently associated with alcohol use severity, as evidenced by the aforementioned significant main effects. It is possible that an individual's perceived level of distress tolerance may be more related to their motives for alcohol use (i.e., avoiding negative affective states), rather than alcohol use severity per se, particularly in firefighter culture where alcohol use is generally prevalent.

As anticipated, there were no significant interactive effects of PTSD symptom severity and distress tolerance with regard to social, enhancement, or conformity motives for alcohol use. The present study is the first, of which we are aware, that has examined the *moderating* effect of distress tolerance on the association between PTSD symptom severity and alcohol use motives with regard to any population type. Although both PTSD symptom severity and distress tolerance were independently and incrementally related to alcohol use conformity motives, an interactive effect did not emerge. Additional work, based upon more representative samples of firefighters and more rigorous methodologies, is necessary to draw more definitive conclusions.

There are notable strengths and certain limitations of this study that should be considered. First, the self-report measures facilitated the screening of a large sample; however, reporting bias and method variance cannot be ruled out. Future research extensions should include quality assurance items (e.g., validation questions) embedded throughout self-report batteries to confirm attention and valid responding, and administer structured, interview-based assessments of PTSD and AUD, whenever possible. Relatedly, the present analysis assessed only perceived distress tolerance as measured via self-report, and therefore, future research may consider examining behavioral indices of distress tolerance among firefighters. A growing literature has demonstrated potentially unique associations of self-report versus behavioral indices of distress tolerance with PTSD symptoms (Vujanovic and Zegel, 2019). In addition, it will be important for future research to extend this work to both positive and negative alcohol use expectancies and to examine the unique contribution of PTSD symptom cluster to these associations (Himmerich and Orcutt, 2019). Second, the cross-sectional design of this study prevents any inferences about causality, and as such, future research is needed employing longitudinal and experimental methodologies. Third, the sample was largely socio-demographically homogeneous. As the respondents identified as predominately White and male, further inquiry is needed to determine potential factors that may have influenced participation in an otherwise racially diverse department. Future research is needed among female as well as racial and ethnic minority firefighters to understand whether these findings generalize across sociodemographic strata. Research among more racially and ethnically diverse firefighters is necessary to more fully understand the role of cultural factors, perceived discrimination, subjective social status, or other sociocultural influences on PTSD, distress tolerance, or alcohol use. Additionally, this department consisted solely of career firefighters working in a large city, which limits our understanding of these associations among rural and/or volunteer firefighters. A crucial strength of this study is the consideration of firefighter culture and lifestyle. Contextual stress variables that were considered for this study included race, ethnicity, educational attainment, romantic relationship status, occupational stress, and trauma load. Future research may also consider income level and firefighters who work multiple jobs. Finally, it should be noted that this study did not include an examination of the influence of co-occurring psychiatric symptoms (e.g., depression, anxiety) in the models, and therefore, it is possible that findings are not unique to PTSD symptoms and may be partly accounted for by other mood or anxiety symptoms.

Future research might build upon this preliminary study by examining the relative contribution of PTSD symptoms to alcohol use among firefighters, after considering the effects of depressive or anxious symptomatology.

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Declaration of Competing Interest

The authors have no conflicts of interest to declare.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.112633.

References

American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental disorders: DSM-5, 5th ed. American Psychiatric Association, Washington, DC.

Bacharach, S.B., Bamberger, P.A., Doveh, E., 2008. Firefighters, critical incidents, and drinking to cope: the adequacy of unit-level performance resources as a source of vulnerability and protection. J. Appl. Psychol. 93 (1), 155–169. https://doi.org/10.1037/0021-9010.93.1.155.

Banducci, A.N., Connolly, K.M., Vujanovic, A.A., Alvarez, J., Bonn-Miller, M.O., 2017. The impact of changes in distress tolerance on PTSD symptom severity post-treatment among veterans in residential trauma treatment. J. Anxiety Disord. 47, 99–105. https://doi.org/10.1016/j.janxdis.2017.01.004.

Barry, K.L., Fleming, M.F., 1993. The Alcohol Use Disorders Identification Test (AUDIT) and the SMAST-13: predictive validity in a rural primary care sample. Alcohol Alcoholism 28 (1), 33–42. https://doi.org/10.1093/oxfordjournals.alcalc.a045346.

Bartlett, B.A., Jardin, C., Martin, C., Tran, J.K., Buser, S., Anestis, M.D., Vujanovic, A.A., 2018. Posttraumatic stress and suicidality among firefighters: the moderating role of distress tolerance. Cognit. Ther. Res. 42 (4), 483–496. https://doi.org/10.1007/s10608-018-9892-y.

Bauer, D.J., Curran, P.J., 2005. Probing interactions in fixed and multilevel regression: inferential and graphical techniques. Mulitvariate Behav. Res. 40, 373–400.

Beaton, R.D., Murphy, S.A., 1993. Sources of occupational stress among firefighter/EMTs and firefighter/paramedics and correlations with job-related outcomes. Prehosp. Disaster Med. 8, 140–150.

Berenz, E.C., McNett, S., Paltell, K., 2019. Development of comorbid ptsd and substance use disorders. In: Vujanovic, A.A., Back, S.E. (Eds.), Posttraumatic Stress and Substance Use disorders: A comprehensive Clinical Handbook. Routledge, New York, pp. 11–27.

Blevins, C.A., Weathers, F.W., Davis, M.T., Witte, T.K., Domin, J.L., 2015. The posttraumatic stress disorder checklist for DSM-5 (PCL-5): development and initial psychometric evaluation. J. Trauma Stress 28, 489–498. https://doi.org/10.1002/jts.

Bohn, M.J., Babor, T.F., Kranzler, H.R., 1995. The alcohol use disorders identification test (AUDIT): validation of a screening instrument for use in medical settings. J. Stud. Alcohol Drugs 56 (4), 423–432. https://doi.org/10.15288/jsa.1995.56.423.

Bovin, M.J., Marx, B.P., Weathers, F.W., Gallagher, M.W., Rodriguez, P., Schnurr, P.P., Keane, T.M., 2016. Psychometric properties of the PTSD checklist for diagnostic and statistical manual of mental disorders-fifth edition (PCL-5) in veterans. Psychol. Assess 28 (11), 1379–1391. https://doi.org/10.1037/pas0000254.

Carey, M.G., Al-Zaiti, S.S., Dean, G.E., Sessanna, L., Finnell, D.S., 2011. Sleep problems, depression, substance use, social bonding, and quality of life in professional firefighters. J. Occupation. Environ. Med. 53 (8), 928–933. https://doi.org/10.1097/JOM.0b013e318225898f.

Cooper, M., Frone, M., Russell, M., Mudar, P., 1995. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. J. Pers. Soc. Psychol. 69 (5), 990–1005.

Cooper, M., Kuntsche, E., Levitt, A., Barber, L., Wolf, S., 2016. Motivational models of substance use: a review of theory and research on motives for using alcohol, marijuana, and tobacco. In: Sher, K.J. (Ed.), The Oxford handbook of Substance Use and Substance Use Disorders. Oxford University Press, New York, NY, pp. 375–421.

Cox, W., Klinger, E., 1988. A motivational model of alcohol use. J. Abnorm. Psychol. 97 (2), 168–180.

Duranceau, S., Fetzner, M.G., Carleton, R.N., 2014. Low distress tolerance and hyperarousal posttraumatic stress disorder symptoms: a pathway to alcohol use. Cognit. Ther. Res. 38 (3), 280–290.

Erwin, M.C., Mitchell, M.A., Contractor, A.A., Dranger, P., Charak, R., Elhai, J.D., 2018. The relationship between distress tolerance regulation, counterfactual rumination, and PTSD symptom clusters. Compr. Psychiatry 82, 133–140. https://doi.org/10.1016/j.comppsych.2018.01.012.

Grant, B.F., Goldstein, R.B., Saha, T.D., Chou, S.P., Jung, J., Zhang, H., . . ., Hasin, D.S., 2015. Epidemiology of DSM-5 alcohol use disorder: results from the National

Epidemiologic survey on alcohol and related conditions iii. JAMA Psychiatry 72 (8), 757–766. https://doi.org/10.1001/jamapsychiatry.2015.0584.

Gulliver, S.B., Zimering, R., Knight, J., Morissette, S., Kamholz, B., Meyer, E., . . ., Kimbrel, N., 2018. Tobacco and alcohol use among firefighters during their first 3 years of service. Psychol. Addict. Behav. 32 (3), 255–263. https://doi.org/10.1037/adb0000366.

Haddock, C.K., Day, R.S., Poston, W.S., Jahnke, S.A., Jitnarin, N., 2015. Alcohol use and caloric intake from alcohol in a national cohort of U.S. career firefighters. J. Stud. Alcohol Drugs 76 (3), 360–366.

Haddock, C.K., Jahnke, S.A., Poston, W.S., Jitnarin, N., Kaipust, C.M., Tuley, B., Hyder, M.L., 2012. Alcohol use among firefighters in the central United States. Occup. Med. (Lond.) 62 (8), 661–664. https://doi.org/10.1093/occmed/kqs162.

Haller, M., Chassin, L., 2014. Risk pathways among traumatic stress, posttraumatic stress disorder symptoms, and alcohol and drug problems: a test of four hypotheses. Psychol. Addict. Behav. 28 (3), 841–851. https://doi.org/10.1037/a0035878.

Hashoul-Andary, R., Assayag-Nitzan, Y., Yuval, K., Aderka, I.M., Litz, B., Bernstein, A., 2016. A longitudinal study of emotional distress intolerance and psychopathology following exposure to a potentially traumatic event in a community sample. Cognit. Ther. Res. 40 (1), 1–13. https://doi.org/10.1007/s10608-015-9730-4.

Haugen, P.T., McCrillis, A.M., Smid, G.E., Nijdam, M.J., 2017. Mental health stigma and barriers to mental health care for first responders: a systematic review and meta-analysis. J. Psychiatr. Res. 94, 218–229.

Himmerich, S., Orcutt, H., 2019. Alcohol expectancies and distress tolerance: potential mechanisms in the relationship between posttraumatic stress and alcohol use. Pers. Individ. Dif. 137, 39–44. https://doi.org/10.1016/j.paid.2018.04.004.

Hoffman, D.A., Gavin, M.B., 1998. Centering decisions in hierarchical linear models: implications for research in organizations. J. Manage. 24, 623–641.

Holliday, S.B., Pedersen, E.R., Leventhal, A.M., 2016. Depression, posttraumatic stress, and alcohol misuse in young adult veterans: the transdiagnostic role of distress tolerance. Drug Alcohol Depend. 161, 348–355. https://doi.org/10.1016/j.drugalcdep.2016.02.030.

Homish, G.G., Hoopsick, R.A., Heavey, S.C., Homish, D.L., Cornelius, J.R., 2019. Drug use and hazardous drinking are associated with PTSD symptoms and symptom clusters in US army reserve/national guard soldiers. Am. J. Addict. 28 (1), 22–28. https://doi.org/10.1111/ajad.12829.

Howell, A.N., Leyro, T.M., Hogan, J., Buckner, J.D., Zvolensky, M.J., 2010. Anxiety sensitivity, distress tolerance, and discomfort intolerance in relation to coping and conformity motives for alcohol use and alcohol use problems among young adult drinkers. Addict. Behav. 35 (12), 1144–1147. https://doi.org/10.1016/j.addbeh.2010.07.003.

Jones, S., 2017. Describing the mental health profile of first responders: a systematic review. J. Am. Psychiatr. Nurses Assoc. 23 (3), 200–214. https://doi.org/10.1177/1078390317695266.

Khantzian, E.J., 1997. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. Harv. Rev. Psychiatry 4 (5), 231–244. https://doi.org/10.3109/10673229709030550.

Kimbrel, N.A., Flynn, E.J., Carpenter, G.S., Cammarata, C.M., Leto, F., Ostiguy, W.J., ..., Gulliver, S.B., 2015. Internal consistency, test-retest reliability, and predictive validity for a likert-based version of the sources of occupational stress-14 (SOOS-14) scale. Psychiatry Res. 228 (3), 961–962. https://doi.org/10.1016/j.psychres.2015.05.031.

Kimbrel, N.A., Steffen, L.E., Meyer, E.C., Kruse, M.I., Knight, J.A., Zimering, R.T., Gulliver, S.B., 2011. A revised measure of occupational stress for firefighters: psychometric properties and relationship to posttraumatic stress disorder, depression, and substance abuse. Psychol. Serv. 8 (4), 294–306. https://doi.org/10.1037/a0025845.

Kuntsche, E., Kuntsche, S., 2009. Development and validation of the drinking motive questionnaire revised short form (DMQ-R SF). J. Clin. Child Adoles. Psychol. 38 (6), 899–908. https://doi.org/10.1080/15374410903258967.

Leyro, T.M., Zvolensky, M.J., Bernstein, A., 2010. Distress tolerance and psychopathological symptoms and disorders: a review of the empirical literature among adults. Psychol. Bull. 136 (4), 576–600. https://doi.org/10.1037/a0019712.

Marshall-Berenz, E.C., Vujanovic, A.A., Macpherson, L., 2011. Impulsivity and alcohol use coping motives in a trauma-exposed sample: the mediating role of distress tolerance. Pers. Individ. Dif. 50 (5), 588–592. https://doi.org/10.1016/j.paid.2010.11.033.

Mazzardis, S., Vieno, A., Kuntsche, E., Santinello, M., 2010. Italian validation of the drinking motives questionnaire revised short form (DMQ-R SF). Addict. Behav. 35 (10), 905–908. https://doi.org/10.1016/j.addbeh.2010.05.002.

McCauley, J.L., Killeen, T., Gros, D.F., Brady, K.T., Back, S.E., 2012. Posttraumatic stress disorder and co-occurring substance use disorders: advances in assessment and treatment. Clin. Psychol. 19 (3). https://doi.org/10.1111/cpsp.1200610.1111/cpsp.12006.

McDevitt-Murphy, M.E., Fields, J.A., Monahan, C.J., Bracken, K.L., 2015. Drinking motives among heavy-drinking veterans with and without posttraumatic stress disorder. J. Addict. Res. Ther. 23 (2), 148–155. https://doi.org/10.3109/16066359.2014.949696.

Meyer, E.C., Zimering, R., Daly, E., Knight, J., Kamholz, B.W., Gulliver, S.B., 2012. Predictors of posttraumatic stress disorder and other psychological symptoms in trauma-exposed firefighters. Psychol. Serv. 9 (1), 1–15. https://doi.org/10.1037/a0026414.

Nemeth, Z., Urban, R., Kuntsche, E., Pedro, S., M., E., Nieto, R., G., J., Farkas, J., . . . Demetrovics, Z., 2011. Drinking motives among Spanish and Hungarian young adults: a cross-national study. Alcohol Alcoholism 46 (3), 261–269. https://doi.org/10.1093/alcalc/agr019.

Newcombe, D.A., Humeniuk, R.E., Ali, R., 2005. Validation of the World Health Organization Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): report of results from the Australian site. Drug Alcohol Rev. 24 (3), 217–226. https://doi.org/10.1080/09595230500170266.

North, C.S., Tivis, L., McMillen, J.C., Pfefferbaum, B., Spitznagel, E.L., Cox, J., . . ., Smith, E.M., 2002. Psychiatric disorders in rescue workers after the Oklahoma city bombing. Am. J. Psychiatry 159 (5), 857–859.

Piazza-Gardner, A.K., Barry, A.E., Chaney, E., Dodd, V., Weiler, R., Delisle, A., 2014. Covariates of alcohol consumption among career firefighters. Occup. Med. (Lond.) 64 (8), 580–582. https://doi.org/10.1093/occmed/kqu124.

Preacher, K.J., Curran, P.J., Bauer, D.J., 2006. Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. J. Educ. Behav. Stat. 31, 437–448.

Roberts, N.P., Roberts, P.A., Jones, N., Bisson, J.I., 2015. Psychological interventions for post-traumatic stress disorder and comorbid substance use disorder: a systematic review and meta-analysis. Clin. Psychol. Rev. 38, 25–38. https://doi.org/10.1016/j.cpr.2015.02.007.

Saunders, J.B., Aasland, O.G., Babor, T.F., De La Fuente, J.R., Grant, M., 1993. Development of the Alcohol Use Disorders Identification Test (AUDIT): who collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction 88, 791–804.

Schmidt, A., Barry, K.L., Fleming, M.F., 1995. Detection of problem drinkers: the Alcohol Use Disorders Identification Test (AUDIT). South. Med. J. 88 (1), 52–59.

Selin, K.H., 2003. Test-retest reliability of the Alcohol Use Disorder Identification Test in a general population sample. Alcohol. Clin. Exp. Res. 27 (9), 1428–1435.

Sheerin, C., Berenz, E.C., Knudsen, G.P., Reichborn-Kjennerud, T., Kendler, K.S., Aggen, S.H., Amstadter, A.B., 2016. A population-based study of help seeking and self-medication among trauma-exposed individuals. Psychol. Addict. Behav. 30 (7), 771–777. https://doi.org/10.1037/adb0000185.

Simons, J.S., Gaher, R.M., 2005. The distress tolerance scale: development and validation of a self-report measure. Motiv. Emot. 29 (2), 83–102.

Smith, L.J., Bartlett, B.A., Tran, J.K., Gallagher, M.W., Alfano, C., Vujanovic, A.A., 2018a. Sleep disturbance among firefighters: understanding associations with alcohol use and distress tolerance. Cognit. Ther. Res. https://doi.org/10.1007/s10608-018-9955-0.

Smith, L.J., Gallagher, M.W., Tran, J.K., Vujanovic, A.A., 2018b. Posttraumatic stress, alcohol use, and alcohol use reasons in firefighters: the role of sleep disturbance. Compr. Psychiatry 87, 64–71. https://doi.org/10.1016/j.comppsych.2018.09.001.

Spiller, S.A., Fitzsimons, G.J., Lynch, J.G., McClelland, G.H., 2013. Spotlights, floodlights, and the magic number zero: simple effects tests in moderated regression. J. Market. Res. 50, 277–288.

Stanley, I.H., Boffa, J.W., Smith, L.J., Tran, J.K., Schmidt, N.B., Joiner, T.E., Vujanovic, A.A., 2018. Occupational stress and suicidality among firefighters: examining the buffering role of distress tolerance. Psychiatry Res. 266, 90–96. https://doi.org/10.1016/j.psychres.2018.05.058.

Stewart, S.H., Pihl, R.O., Conrod, P.J., Dongier, M., 1998. Functional associations among trauma, PTSD, and substance-related disorders. Addict. Behav. 23, 797–812. https://doi.org/10.1016/S0306-4603(98)00070-7.

Tomaka, J., Magoc, D., Morales-Monks, S.M., Reyes, A.C., 2017. Posttraumatic stress symptoms and alcohol-related outcomes among municipal firefighters. J. Trauma Stress 30 (4), 416–424. https://doi.org/10.1002/jts.22203.

Ullman, S.E., Filipas, H.H., Townshend, S.M., Starzynski, L.L., 2005. Trauma exposure, posttraumatic stress disorder and problem drinking in sexual assault survivors. J.. Stud. Alcohol 66, 610–619.

Vinci, C., Mota, N., Berenz, E., Connolly, K., 2016. Examination of the relationship between PTSD and distress tolerance in a sample of male veterans with comorbid substance use disorders. Mil. Psychol. 28 (2), 104–114. https://doi.org/10.1037/mil0000100.

Vujanovic, A.A., Bonn-Miller, M.O., Potter, C.M., Marshall, E.C., Zvolensky, M.J., 2011a. An evaluation of the relation between distress tolerance and posttraumatic stress within a trauma-exposed sample. J. Psychopathol. Behav. Assess. 33 (1), 129–135.

Vujanovic, A.A., Dutcher, C.D., Berenz, E.C., 2017. Multimodal examination of distress tolerance and posttraumatic stress disorder symptoms in acute-care psychiatric inpatients. J. Anxiety Disord. 48, 45–53. https://doi.org/10.1016/j.janxdis.2016.08.005.

Vujanovic, A.A., Hart, A.S., Potter, C.M., Berenz, E.C., Niles, B., Bernstein, A., 2013. Main and interactive effects of distress tolerance and negative affect intensity in relation to ptsd symptoms among trauma-exposed adults. J. Psychopathol. Behav. Assess. 35 (2), 235–243.

Vujanovic, A.A., Marshall-Berenz, E.C., Zvolensky, M.J., 2011b. Posttraumatic stress and alcohol use motives: a test of the incremental and mediating role of distress tolerance. J. Cogn. Psychother. 25 (2), 130–141.

Vujanovic, A.A., Zegel, M., 2019. Distress tolerance and posttraumatic stress. In: Tull, M.T., Kimbrel, N.A. (Eds.), Emotion in Posttraumatic Stress disorder: Etiology, assessment, neurobiology, and Treatment. Guilford Press, New York.

Watkins, L.E., Sprang, K.R., Rothbaum, B.O., 2018. Treating PTSD: a review of evidence-based psychotherapy interventions. Front Behav. Neurosci. 12, 258. https://doi.org/10.3389/fnbeh.2018.00258.

Weathers, F.W., Blake, D.D., Schnurr, P.P., Kaloupek, D.G., Marx, B.P., Keane, T.M., 2013. The life events checklist for DSM-5 (LEC-5). Instru. Available Natl. Center PTSD at.

Williams, C.L., Vik, P.W., Wong, M.M., 2015. Distress tolerance in social versus solitary college student drinkers. Addict. Behav. 50, 89–95. https://doi.org/10.1016/j.addbeh.2015.06.025.