



Understanding mental health among military veterans in the fire service

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ABSTRACT

Firefighters who have previously served in the military may be at potentially higher risk for worsened mental health outcomes. This investigation examined the mental health of military veterans, as compared to non-veterans, in the fire service. We hypothesized that firefighters who endorsed military veteran status would have higher rates of mental health symptoms, in comparison to firefighters who did not endorse prior service in the military. Age, gender, and race/ethnicity were used as covariates. The sample was comprised of 910 career firefighters, 209 (23.0%) of whom endorsed military veteran status. One-way analyses of covariance were employed. The military veteran subsample reported significantly higher levels of sleep disturbance, depression, and posttraumatic stress symptom severity in comparison to the non-veteran subsample; however, effect sizes were small indicating that between group differences are actually negligible. Results highlight the need to improve our understanding of risk and resilience factors for firefighters who have served in the military, as this line of inquiry has potentially important mental health intervention implications for this exceptionally understudied population.

1. Introduction

Firefighters represent a unique population by virtue of their exposure to chronic stress and potentially traumatic events (PTE, e.g., natural disasters, car accidents, terrorist attacks; (McCammom, 1996). Thus, firefighters are at heightened risk for the development of negative mental health outcomes, such as alcohol misuse, depression, suicidal thoughts/behaviors, and posttraumatic stress disorder (PTSD; Haslam and Mallon, 2003; Martin et al., 2017; Stanley et al., 2016). Despite the elevated risk for psychological disturbances among firefighters, there still remains a dearth of information regarding their mental health. Recent guidelines from the National Fallen Firefighters Foundation underscore as the highest priority efforts aimed at identifying and studying segments of firefighters who are at heightened risk for psychological disturbance (National Fallen Firefighters Foundation, 2016). Hence, further research is needed to understand correlates of mental health outcomes in firefighters, generally, and to identify segments of firefighters who may be at elevated risk for psychological disturbances. These research efforts have significant potential to inform evidence-based intervention and prevention efforts for this vulnerable, understudied population.

Military veterans are one such segment of the firefighter population that may be at increased risk for the development of negative mental health outcomes. Previous research has suggested that up to 44% of

firefighters in the U.S. are military veterans (Meyer et al., 2012). Notably, the proportion of military veterans in the Meyer et al. (2012) study may have been due, in part, to higher-priority hiring policies for veterans in that particular department. To date, there have been no published studies examining nationally representative samples of U.S. firefighters, and as a result, no estimates on the proportion of firefighters with military service experience are available. Similar to firefighters, military veterans may experience chronic exposure to stress (e.g., deployment) and PTE (e.g., killing during combat; Maguen et al., 2011). As such, a vast literature has documented that military veterans experience high rates of various types of adverse mental health outcomes (e.g., alcohol use disorder, PTSD, suicide; Jacobson et al., 2008; Seal et al., 2009; U.S. Department of Veterans Affairs, 2016), in comparison to the general population.

Although research examining military veteran subsamples in comparison to non-veteran subsamples among firefighters is scarce, available research suggests that firefighters who have served in the military are at risk for worsened mental health outcomes in comparison to firefighters who have not served in the military. For example, Stanley et al. (2015) found that active duty military status among firefighters was associated with increased risk for reporting suicidal thoughts and behaviors. Similarly, Paulus et al. (2017) noted significantly higher PTSD and depressive symptoms among firefighters who endorsed active duty military status. Unfortunately, no studies to

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date have been focused explicitly upon understanding the mental health of military veterans in the fire service.

Theoretically, the potentially stressful and traumatic events experienced by firefighters who served in the military may predispose them to higher levels of psychological disturbances, as a result of progressively increased responsivity to additional traumas or stressors endured in the fire service. For example, the stress sensitization model, defined as an individual's enhanced reactivity to stressors as a result of prior exposure to extreme stressors (Hammen et al., 2000; Smid et al., 2012), has been supported among trauma-exposed populations including combat veterans (Smid et al., 2013, 2012). Thus, individuals who begin a firefighter career with prior exposure to military-related stressors and military-related PTE may be particularly vulnerable to developing negative mental health consequences once exposed to the stressors of the fire service.

Therefore, the current study aimed to contribute to the extant literature by providing a focused examination on the mental health symptomatology of military veterans, as compared to non-veterans, within the fire service. Specifically, we compare military veterans and non-veterans in the fire service on the following mental health outcomes: alcohol use, sleep disturbance, depression, suicidality, trauma exposure, and posttraumatic stress symptoms. We hypothesized that firefighters who endorsed military veteran status would report higher rates of trauma exposure and general mental health symptomatology, across all indices, in comparison to firefighters who did not endorse prior service in the military. We also conducted exploratory analyses comparing military veteran and non-military veteran firefighters on cutoff scores for potentially hazardous drinking, significant sleep disturbance, clinical depression, global suicide risk, and PTSD diagnosis.

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. The overall sample included 910 career firefighters (94.7% male; $M_{age} = 38.4, SD = 8.6$), of whom 5 endorsed current active duty status and 204 endorsed prior active duty status. For the purposes of this study, we combined firefighters endorsing current and past active military duty to represent military veteran status. Thus, our sample included 209 (23.0%) firefighters who were military veterans (96.7% male; $M_{age} = 39.9, SD = 6.5$) and 700 who were non-veterans (94.1% male; $M_{age} = 38.0, SD = 9.2$). Please see Table 1 for participant characteristics. Participants were career firefighters, who perform both Emergency Medical Services (EMS) and fire suppression services, at a fire department in a large metropolitan area in the southern U.S. To be included in the study, participants must: be 18 years of age or older, be current firefighters, and have consented to participation and completion of all online questionnaires. Exclusionary criteria were comprised of inability or unwillingness to provide informed consent for the completion of the online questionnaires. Please see Procedures section for more information.

2.2. Measures

Demographic questionnaire. Participants were asked to self-report demographic information including sociodemographic factors, firefighter service history, and military service history.

Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente, and Grant, 1993). The AUDIT is an extensively validated 10-item, Likert-style screening instrument that was developed by the World Health Organization and designed to identify individuals presenting with alcohol problems (Newcombe, Humeniuk, & Ali, 2005; Saunders et al., 1993). Scores range from 0 to 40, and the generally accepted cut-off to identify potentially hazardous drinking is 8. The

Table 1
Participant demographic characteristics.

M/n (SD/%)	Full sample (n = 910)	Veterans (n = 209)	Non-veterans (n = 700)	p-value
Age¹	38.40 (8.64)	39.88 (6.46)	37.96 (9.15)	0.001
Gender¹				0.048
Male	862 (94.7%)	202 (96.7%)	659 (94.1%)	
Female	43 (4.7%)	7 (3.3%)	36 (5.1%)	
Transgender	5 (0.5%)	0 (0%)	5 (0.7%)	
Race/Ethnicity¹				0.024
White	675 (74.2%)	153 (73.2%)	521 (74.4%)	
Hispanic/Latino	250 (27.5%)	67 (32.1%)	183 (26.1%)	
Black/African American	117 (12.9%)	34 (16.3%)	83 (11.9%)	
'Other'	84 (9.2%)	12 (5.7%)	72 (10.3%)	
Asian	17 (1.9%)	5 (2.4%)	12 (1.7%)	
Native Hawaiian/ Pacific Islander	1 (0.1%)	0 (0%)	1 (0.1%)	
American Indian/ Alaskan Native	16 (1.8%)	5 (2.4%)	11 (1.6%)	
Education¹				0.155
8th Grade	4 (0.4%)	1 (0.5%)	3 (0.4%)	
GED (or equivalent)	7 (0.8%)	2 (1.0%)	5 (0.7%)	
High School	75 (8.2%)	26 (12.4%)	49 (7.0%)	
Some College	427 (46.9%)	113 (54.1%)	314 (44.9%)	
Bachelor's Degree	397 (43.6%)	67 (32.1%)	329 (47.0%)	
Marital status¹				0.354
Married	623 (68.5%)	145 (69.4%)	477 (68.1%)	
Divorced	55 (6.0%)	24 (11.5%)	31 (4.4%)	
Living with Partner	45 (4.9%)	4 (1.9%)	41 (5.9%)	
Single	185 (20.3%)	36 (17.2%)	149 (21.3%)	
Widowed	2 (0.2%)	0 (0%)	2 (0.3%)	
Employment status¹				0.950
Part-time Paid	14 (1.5%)	3 (1.4%)	11 (1.6%)	
Part-time Volunteer	3 (0.3%)	1 (0.5%)	2 (0.3%)	
Full-time Paid	888 (97.7%)	204 (97.6%)	684 (97.7%)	
Full-time Volunteer	4 (0.4%)	1 (0.5%)	3 (0.4%)	
Years of service in department¹	13.17 (9.12)	12.65 (6.64)	13.33 (9.74)	0.243
Military characteristics¹	–			
Current active duty status	–	5 (0.02%)	–	
Years of active duty service	–	4.79 (2.70)	–	
Average number of deployments	–	1.78 (1.89)	–	
Deployed in OEF/OIF	–	84 (40.6%)	–	
Served in combat/war zone	–	107 (51.7%)	–	
Military branch¹				
Army	–	87 (41.6%)	–	
Navy	–	44 (21.1%)	–	
Air Force	–	13 (6.2%)	–	
Marine Corps	–	57 (27.3%)	–	
Coast Guard	–	7 (3.3%)	–	
Army National Guard	–	14 (6.7%)	–	
National Reserves	–	11 (5.3%)	–	

Note: ¹Demographics questionnaire; OEF/OIF = Operation Enduring Freedom/Operation Iraqi Freedom

AUDIT has demonstrated good test-retest reliability (Selin, 2003) and convergent (García Carretero, Novalbos Ruiz, Martínez Delgado, & O'Ferrall Gonzalez, 2016) and discriminant validity (Bohn, Babor, & Kranzler, 1995). The AUDIT has demonstrated high sensitivity and specificity for detecting probable alcohol dependence and hazardous or harmful drinking (sensitivity = 32–96%, specificity = 84–96%; Barry & Fleming, 1993; Saunders et al., 1993; Schmidt, Barry, & Fleming, 1995). In the present study, internal consistency for the total AUDIT score ($\alpha = 0.87$) was good.

Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a 19-item self-report measure of sleep disturbances during the previous month. The PSQI subscales include subjective sleep quality, sleep latency, sleep duration, habitual

sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. Component scores are summed to create a global sleep score that range from 0 to 21, with higher scores indicating increased sleep disturbance. A cutoff score of ≥ 5 has been recommended to signify significant sleep disturbance (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Recent meta-analytic evidence for the PSQI indicates strong test-retest reliability as well as convergent and discriminant validity (Mollayeva et al., 2016). In the present study, internal consistency of the PSQI was acceptable ($\alpha = 0.79$).

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item self-report measure used to assess depressive symptomatology. Items are scored on a 4-point scale (0 = rarely or none of the time/less than 1 day to 3 = most or all of the time/5–7 days) with regard to the frequency in which individuals have been bothered by the symptom in the past week. Total symptom severity scores range from 0–60, with higher total scores indicating greater depressive symptom severity. The CES-D has demonstrated high internal consistency, moderate test-retest reliability, and good convergent and discriminant validity. A recommended cutoff score of ≥ 22 to indicate clinical depression levels has been used in prior studies with firefighters (Tak et al., 2007). In the present study, internal consistency for the CES-D total score was excellent ($\alpha = 0.92$).

Suicide Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001). The SBQ-R, identified as a gold standard assessment (Batterham et al., 2015), is a 4-item self-report measure of suicide risk. Each item assesses a different aspect of suicidality, including *lifetime* suicide ideation and/or suicide attempts (i.e., “Have you ever thought about or attempted to kill yourself?”); *frequency* of suicidal ideation over the past twelve months (i.e., “Have often have you thought about killing yourself in the past year?”); *threat* of suicide attempt (i.e., “Have you ever told someone that you were going to commit suicide, or that you might do it?”); and self-reported *likelihood* of suicidal behavior in the future (i.e., “How likely is it that you will attempt suicide someday?”). Total scores range from 3–18, with higher scores indicating greater levels of suicide risk. Suggested cutoff scores to identify at-risk individuals and specific risk behaviors for the adult general population are ≥ 7 and ≥ 8 for psychiatric inpatient populations (Osman et al., 2001). The total SBQ-R demonstrates good psychometric properties for adult inpatient populations, including sensitivity (93%), specificity (95%), positive predictive value (0.87), and discrimination (0.89; Osman et al., 2001; Batterham et al., 2015). In the present study, internal consistency was acceptable ($\alpha = 0.79$).

Life Events Checklist Version-5 (LEC-5; Weathers et al., 2013). The LEC-5 is a self-report questionnaire used to screen for PTE experienced at any time throughout the lifespan. Respondents are presented with 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 were 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 the particular traumatic event type. Total exposures were summed to produce a variable indicating the total number of traumatic life event types experienced. In the current sample, internal consistency for the total number of traumatic life event types experienced variable was excellent ($\alpha = 0.94$).

PTSD Checklist-Civilian Version-5 (PCL-5; Blevins et al., 2015). 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 the *DSM-5* criteria (i.e., intrusions, avoidance, negative alternations in cognition and mood, arousal; American Psychiatric Association, 2013). Respondents rate each item on a 5-point scale (0 = Not at all to 4 = Extremely) to indicate the frequency with which they have been bothered by the symptom in the past month. Total symptom severity scores range from 0–80, with higher

scores indicating higher symptom severity. The PCL-5 has demonstrated good psychometric properties (Blevins et al., 2015; Briere, 2001; Morey, 2007; Weathers et al., 1993). The current literature recommends a PTSD diagnostic cut-off score of ≥ 33 (e.g., Bovin et al., 2016). In the current study, respondents must have endorsed one or more lifetime traumatic events (as assessed by the LEC-5) to be evaluated for PTSD symptoms. In the present study, internal consistency was excellent for the PCL-5 total score ($\alpha = 0.97$).

2.3. Procedure

All firefighters were recruited for participation in the parent study through a department-wide e-mail sent to all firefighters, inviting them 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 theatre passes). Firefighters were provided with a description of the survey and the choice to review 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’). Participants interested in taking part (by clicking ‘yes’) were directed to the informed consent form. Once firefighters electronically signed the consent form, they were directed to the survey. Firefighters had the option to discontinue participation at any time without penalty. The study was approved by all relevant institutional review boards in accordance with the Declaration of Helsinki. All data were de-identified and confidentiality safeguards were enacted in line with relevant regulatory guidelines.

2.4. Data analytic strategy

All analyses were conducted using IBM SPSS version 24.0. First, frequency distributions were examined among all variables to ensure normalcy of the distribution and examine the data for missingness. Less than 5% of the data across all variables were missing. Missing data were handled via list-wise deletion. Second, descriptive statistics were evaluated for the whole sample, as well as for military veteran and non-veteran subsamples. Third, independent samples *t*-tests were conducted to evaluate between-group differences (military veterans vs. non-veterans) on all demographic variables. Covariates were those variables for which significant between-group differences were detected. Fourth, one-way analyses of covariance (ANCOVA) were conducted to evaluate statistically significant differences between military veterans and non-veterans with regard to alcohol use severity (AUDIT: total score), sleep disturbance (PSQI: total score), depressive symptoms (CESD: total score), suicidality (SBQ-R: total score), trauma exposure (LEC-5: total score), and PTSD symptom severity (PCL-5: total score), controlling for covariates. A Bonferroni correction was applied to control for family-wise error rate across the six planned comparisons ($\alpha = 0.05/6 = 0.008$). Post hoc analyses utilized chi-square tests of independence to evaluate statistically significant differences between military veterans and non-veterans with regard to suggested cut-offs for potentially hazardous drinking (AUDIT: total score ≥ 8), significant sleep disturbance (PSQI: total score ≥ 5), clinical depression (CESD: total score ≥ 22), global suicide risk (SBQR: total score ≥ 7), and PTSD diagnosis (PCL-5: total score ≥ 33). A Bonferroni correction was applied to control for Type I error across the five planned comparisons ($\alpha = 0.05/5 = 0.01$).

3. Results

Descriptive statistics among all demographic variables are presented in Table 1. Significant between-group differences were noted with regard to age, gender, and race/ethnicity, and these variables were included as covariates in subsequent analyses.

Table 2
Firefighters: comparing mental health variables among military veterans and non-veterans.

M/n (SD/%)	Full sample (n = 910)	Veterans (n = 209)	CI (99%)	Veterans Adj Means	Non-veterans (n = 700)	CI (99%)	Non-veterans Adj Means	ANCOVA			
								df	F-value	p-value	η ²
AUDIT Total ¹	6.33 (4.78)	6.69 (5.29)	[5.78–7.90]	6.84 (0.41)	6.21 (4.62)	[5.60–6.75]	6.17 (0.22)	(1, 585)	2.03	0.155	0.003
PSQI ²	5.76 (3.70)	6.49 (4.40)	[5.81–7.30]	6.56 (0.29)	5.54 (3.45)	[5.12–5.92]	5.52 (0.16)	(1, 724)	10.00	0.002*	0.01
Depression Total ³	10.58 (7.90)	11.89 (9.04)	[10.42–13.50]	11.96 (0.60)	10.18 (7.48)	[9.32–11.00]	10.16 (0.33)	(1, 762)	6.99	0.008*	0.01
Suicidality Total ⁴	3.82 (1.76)	3.91 (1.72)	[3.59–4.25]	3.92 (0.13)	3.80 (1.77)	[3.62–3.97]	3.80 (0.07)	(1, 824)	0.74	0.390	0.001
Suicidal Ideation ⁵	182 (20.0%)	47 (22.5%)	–	–	135 (19.3%)	–	–	–	–	–	–
Suicide Attempt ⁶	8 (0.91%)	1 (0.48%)	–	–	7 (1.0%)	–	–	–	–	–	–
Endorsed Trauma ⁷ (yes/no)	765 (84.1%)	178 (85.2%)	[10.66–14.32]	–	587 (83.9%)	[9.89–11.89]	–	(1, 158)	3.95	0.049	0.02
PCL Total ⁸	9.46 (14.36)	12.19 (16.36)	[9.40–15.05]	12.23 (1.09)	8.64 (13.61)	[7.15–10.30]	8.73 (0.61)	(1, 721)	7.79	0.005*	0.01

Note: Bonferroni correction = $p \leq 0.008$. ¹Alcohol Use Disorders Identification Test total score (AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993); ²Pittsburgh Sleep Quality Index total score (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989); ³Center for Epidemiologic Studies Depression Scale total score (CES-D; Radloff, 1977); ⁴Suicide Behaviors Questionnaire- Revised total score (SBQ-R; Osman et al., 2001); ⁵SBQ-R item 1 Suicidal ideation; ⁶SBQ-R item 2 Suicidal attempt; ⁷Life Events Checklist for the DSM-5 indicated via “Happened to me”, “Witnessed it”, and/or “Part of my job” (LEC-5; Weathers et al., 2013); ⁸Posttraumatic Stress Disorder Checklist total score (PCL-5; Blevins et al., 2015).

3.1. Main analyses

Please see Table 2 for a summary of descriptive mental health data and between-group differences, as determined by ANCOVA. Notably, the military veteran subsample, as compared to the non-veteran subsample, reported significantly higher means with regard to sleep disturbance (PSQI: total score), depression (CES-D: total score), and PTSD symptom severity (PCL-5: total score). Effect sizes for all significant differences were small (η^2 's = 0.01). No significant between-group differences were noted for alcohol use (AUDIT: total score), trauma exposure (LEC: total score), or suicidality (SBQ-R: total score).

3.2. Post hoc exploratory analyses

Please see Table 3 for a summary of descriptive mental health data and between group differences, as determined by chi-square tests of independence. Notably, a significantly higher number of firefighters who endorsed military veteran status met or exceeded the suggested cutoff for clinical depression, as compared to the non-veteran subsample. However, the effect size for this significant difference was small ($\phi_c = 0.01$). Given the Bonferroni correction applied, no other group comparisons were statistically significant.

4. Discussion

The current study examined mental health symptomatology of military veterans, as compared to non-military veterans, in the fire

Table 3
Post hoc analyses: comparing suggested diagnostic cut-off scores among military veterans and non-veterans.

	N (%)	df	χ ²	p-value	φ _c
Potential hazardous drinking ¹	163 (27.6%)	1	0.024	0.877	0.01
Significant sleep disturbance ²	412 (43.2%)	1	0.448	0.503	0.03
Clinical depression ³	75 (9.8%)	1	7.821	0.005*	0.10
Global suicide risk ⁴	62 (7.5%)	1	4.910	0.027	0.08
PTSD diagnosis ⁵	72 (9.3%)	1	3.121	0.077	0.07

Note: Bonferroni correction: * $p < .01$. ¹Potential hazardous drinking cutoff score ≥ 8 , Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993); ²Significant sleep disturbance cutoff score ≥ 5 , Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989); ³Clinical depression cutoff score ≥ 22 , Center for Epidemiologic Studies Depression Scale total score (CES-D; Radloff, 1977); ⁴Global suicidal risk cutoff ≥ 7 , Suicide Behaviors Questionnaire- Revised total score (SBQ-R; Osman et al., 2001); ⁵PTSD diagnostic cutoff score ≥ 33 , Post-traumatic Stress Disorder Checklist (PCL-5; Blevins et al., 2015).

service. Our hypothesis was partially supported by the data. First, firefighters who were military veterans, compared to non-veterans, reported significantly greater levels of sleep disturbance ($\eta^2 = 0.01$), depression ($\eta^2 = 0.01$), and PTSD ($\eta^2 = 0.01$) symptomatology, although the magnitude of the between-group effects was small. Post hoc analyses revealed that military veteran firefighters also met significantly higher rates of clinical depression, in comparison to non-veteran firefighters ($\phi_c = 0.01$); although the magnitude of the between-group effects was also small. Although firefighters commonly experience disturbed sleep due to long shifts and unpredictable schedules (Saijo et al., 2008), this is one of few studies (Carey et al., 2011; Hom et al., 2016; Vargas de Barros et al., 2013) to evaluate sleep disturbance in this population. As compared to other firefighter samples, this sample endorsed lower rates of depression and sleep disturbance, as measured by the CES-D and PSQI (Carey et al., 2011; Saijo et al., 2008; Tak et al., 2007), but higher rates of PTSD symptomatology (Berninger et al., 2010; Corrigan et al., 2009; Paulus et al., 2017). Broadly, our results are consistent with findings that have shown mental health symptoms, such as PTSD and depression, to be higher among firefighters who endorsed active duty military status (Paulus et al., 2017). However, the small effect sizes in the context of a relatively large sample are noteworthy and suggest careful interpretation of the results. Indeed, despite statistical significance, the effect size comparisons indicate that military veteran versus non-veteran differences are actually negligible. These findings therefore accentuate between-group similarities, rather than differences. Theoretically, it is possible that military veterans who self-select into the fire service may be especially resilient by virtue of their interest in pursuing intrinsically stressful careers marked by unpredictability. If true, this finding might illuminate important future research directions aimed at characterizing the resilience of military veterans who pursue careers as first responders. Given these findings, and the chronic nature of stress and exposure to PTE that both veterans and firefighters experience, it is imperative that future research continue to explore psychological functioning correlates among this extremely unique population.

Contrary to our hypothesis, there was no significant difference in trauma exposure, alcohol use or suicidality (e.g., suicidal thoughts/behaviors), as measured by the SBQ-R, between military veteran and non-veteran firefighters. This is inconsistent with existing, albeit scarce, research that has documented higher rates of both alcohol use and suicidality in military veterans, as compared to non-veterans, in the fire service (Paulus et al., 2017; Stanley et al., 2015). Notably, there is no research to date specifically examining significant differences in trauma exposure between military veteran and non-veteran firefighters. Given the high rates of trauma exposure among firefighters, generally, there may not be significant variability with regard to trauma load regardless

of veteran status. Furthermore, while overall levels of alcohol use in this sample and in other samples of firefighters are higher than the general population (Boxer and Wild, 1993; Carey et al., 2011; Grant et al., 2015; Haddock et al., 2012; Martin et al., 2017), firefighters in the current study may have underreported general rates of alcohol use due to potential stigma associated with negative health behaviors and mental health concerns in the fire service (Henderson et al., 2016). The lack of significant differences in suicidality between military veterans and non-veterans on the SBQ-R may be due to the nature of the measure. Although psychometrically validated and demonstrated to be a gold standard assessment instrument for suicide risk (Batterham et al., 2015), the SBQ-R does not distinguish well between suicidal ideation and behavior (e.g., attempt). Further, the firefighters surveyed work in one of the few fire departments in the U.S. that proactively implemented a suicide prevention program for their employees (Finney et al., 2015) several years ago, indicating that these particular firefighters may have greater awareness of suicidality and greater access to mental health services, therefore resulting in lower levels of suicidality. Indeed, firefighters in this sample reported lower rates of suicidal ideation and attempt in comparison to other samples of firefighters (Stanley et al., 2015). Lastly, it might be noted that all significant findings demonstrated small effect sizes and actually converge across measures (i.e., PSQI total score; CES-D total score; PCL-5 total score).

Taken together, study findings should be interpreted in the context of limitations. First, effects of method variance and reporting bias cannot be ruled out given that this study relied exclusively on self-report. Hence, future studies should integrate interview-based and experimental measures to assess mental health outcomes. Second, the majority of this sample was comprised of male firefighters who identified as white/Caucasian and limits our understanding of the unique experiences and needs of female firefighters as well as those with different racial and ethnic backgrounds. Third, given the cross-sectional design employed in this study, no inferences regarding causality among variables can be inferred. Prospective, longitudinal studies are needed for the purposes of tracking military veteran firefighters' stress and health over time in order to better understand risk for psychopathology. Fourth, we do not have information regarding the specific military branches of the five firefighters endorsing active duty military status in our sample. Future work might incorporate more detailed assessment of past and present military service to better understand how military service history may impact mental health functioning among firefighter populations. Fifth, our sample were comprised of primarily career firefighters, therefore our results may not be generalizable to volunteer firefighters. It is important for future work to extend this line of inquiry to volunteer firefighter samples, who have been shown to have slightly elevated levels of psychiatric symptoms as compared to career firefighters (Stanley et al., 2017). Further, our study did not incorporate validity checks, or items embedded in the survey to confirm adequate attention to question content. Future large-scale survey studies of firefighters might consider including validity items to ascertain accuracy of responding. Lastly, our sample of firefighters was derived from a large, urban fire department. Findings may not generalize to rural firefighters due to differences in rates and types of trauma exposures. Thus, the need for replication with nationally-representative samples of firefighters is underscored.

Despite these limitations, the current study is the first study to focus on the mental health of military veteran firefighters, as compared to firefighters without a military service history. Future work focused on firefighters, generally, and military veterans in the fire service, more specifically, is imperative to improve our understanding of risk and resilience factors of populations chronically exposed to stress and PTE. Moreover, work examining specific characteristics of military service experiences (e.g., combat exposure; number of deployments) and their potentially unique effects on mental health among firefighters may be of paramount importance in better understanding potentially

vulnerable segments of the firefighter population. Indeed, military veterans and firefighters are unique populations in need of greater attention and understanding given their services to our country and to our communities. This line of inquiry has potentially important clinical implications for mental health intervention and prevention efforts.

Declarations of interest

None.

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