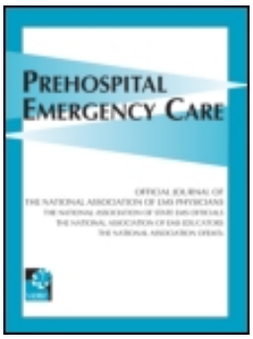

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Work-Related Stress and Posttraumatic Stress in Emergency Medical Services

Elizabeth Donnelly, PhD, MPH, NREMT-B

Abstract

Introduction. Recent research efforts in emergency medical services (EMS) has identified variability in the ability of EMS personnel to recognize their level of stress-related impairment. Developing a better understanding of how workplace stress may affect EMS personnel is a key step in the process of increasing awareness of the impact of work-related stress and stress-related impairment. **Objective.** This paper demonstrates that for those in EMS, exposure to several types of workplace stressors is linked to stress reactions. Stress reactions such as posttraumatic stress symptomatology (PTSS) have the potential to negatively influence the health of EMS providers. This research demonstrates that two different types of work-related stress and alcohol use influence the development of PTSS. **Methods.** A probability sample of nationally registered emergency medical technician (EMT)-Basics and EMT-Paramedics (n = 1,633) completed an Internet-based survey. Respondents reported their levels of operational and organizational types of chronic stress, critical incident stress, alcohol use, and PTSS. **Results.** Ordinary least squares regression illustrated that when demographic factors were controlled, organizational and operational forms of chronic stress, critical incident stress, and alcohol use were all significant predictors of PTSS ($p < 0.01$). Inclusion of an interaction effect between operational stress and critical incident stress ($p < 0.01$) as well as between operational stress and alcohol use ($p < 0.01$) created a robust final model with an R^2 of 0.343. **Conclusion.** These findings indicate that exposure to both chronic and critical incident stressors increases the risk of EMS providers' developing a posttraumatic stress reaction. Higher levels of chronic stress, critical incident stress, and alcohol use significantly related to an increased level of PTSS. Further, for those reporting high levels of alcohol use or critical incident stress, interactions with high levels of chronic operational stress were associated with higher rates of PTSS. For those interested in the impact of work-related stress in EMS, these findings indicate that attention must be paid to levels of stress associated with both critical incident exposure as well as the chronic stress providers experience on a day-to-day basis. **Key words:** emergency medical services; mental health; stress disorders, posttraumatic; workplace; stress, psychological

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Introduction

Emergency medical technicians (EMTs) are exposed to a host of workplace stressors. One hundred percent of EMTs report being exposed to traumatic events on the job,[1] and EMTs report high levels of workplace stress.[2,3] Recent research highlights variation in the ability of EMTs to recognize their level of stress-related impairment.[4] This variation is concerning, as exposure to workplace stressors have been linked to a number of negative physical and mental health outcomes.[5] In order to help EMTs recognize when they are impaired because of stress, it is essential to develop a better understanding of the types of workplace stress and how workplace stress may contribute to a stress reaction. Two types of work-related stress, chronic stress and critical incident stress, are commonly cited sources of workplace stress among EMTs.[6,7]

Chronic stress is defined as "relatively enduring problems, conflicts and threats that many people face in their daily lives."[8(p245)] Previous research in EMS has identified chronic work stressors such as conflict with supervisors,[3,9–12] lack of support from or conflict with colleagues,[3,9–16] and an inadequate salary.[3,10] Chronic work stress has been linked to low job satisfaction, poor physical health, fatigue, burnout, and posttraumatic stress symptomatology (PTSS) in EMS personnel.[3,9,12] *Critical incident stress* is typically associated with the provision of patient care and is defined as "any situation faced by emergency services personnel that causes them to experience unusually strong emotional reactions which have the potential to interfere with their ability to function either at the scene or later."[17(p36)] Critical incident exposure in EMS has been linked to burnout and posttraumatic stress disorder (PTSD).[1,13,16,18–20]

The understanding of how stress impacts EMS workers is limited. Previous studies of stress among EMS workers examined the influence of either chronic stress or critical incident stress. These studies provide a limited view of the association between work-related

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stressors and negative psychological outcomes, as only a few European studies consider the influence of both types of stress together.[3,12,15] No extant research assesses the impact of chronic stress, critical incident stress, and alcohol use on psychological outcomes in EMS. The purpose of this study, theoretically grounded in the stress process model,[8,21] was to examine how chronic stress, critical incident stress, and alcohol use influence the development of PTSS in emergency services personnel.

METHODS

Study Design and Ethical Review

This study used a survey design and probabilistic sample of EMTs certified by the National Registry of Emergency Medical Technicians (NREMT) and was approved by the Florida State University Institutional Review Board.

Study Sample

This study surveyed a systematic probability sample of nationally certified EMTs. The NREMT maintains a registry of over 320,000 responders, of whom 220,547 are EMT-Basics and 72,544 are EMT-Paramedics.[22] The mean age of the EMT-Basics is 34.9 years, 90.2% are white, and 71.2% are male. The paramedics have a mean age of 35.1 years, 92.3% are white, and 69% are male.[23]

To optimize the power of the study, a power analysis was conducted to ascertain the required sample size to detect small effects ($\alpha = 0.05$, $\beta = 0.95$). Analyses revealed that an optimal sample would entail at least 1,500 respondents. After reviewing the literature on response rates to Internet-based surveys, it was determined that a sample of $n = 12{,}000$ would produce the desired number of responses. Respondents had to be currently certified by the NREMT and have an e-mail address on file in the NREMT's database; a total of 87,731 EMT-Basics and 22,735 EMT-Paramedics met the criteria for inclusion in the sample.

Methods of Measurement

Three previously standardized instruments and one inventory was used to capture measurements of occupational stress, alcohol use, and PTSD.

Alcohol Use

The Alcohol Use Disorders Identification Test (AUDIT)[24–27] was utilized to assess alcohol use. The AUDIT consists of 10 items, three questions on drinking frequency, three questions on alcohol dependence, and four questions on problems caused by alcohol. The total score indicates the relative risk of hazardous drinking and is created by summing responses. Scores can vary from 0 to 40. A score of 8 or more indicates a hazardous level of alcohol problems, and a score of 15 or more indicates harmful consumption.[28] A 2007 review of the literature found that 18 studies had used the AUDIT since 2002, and reported a median coefficient reliability of 0.83 (range 0.75 to 0.97) as well as acceptable test–retest reliability and strong criterion validity across demographic variables such as race and gender.[29] The AUDIT has been used in past research with both ambulance personnel and police officers[30–33] and was not altered for inclusion in this study.

Posttraumatic Stress Symptomatology

The PTSD Checklist (PCL)[34] was used to assess for posttraumatic stress. The PTSD Checklist–Military (PCL-M) is a 17-item scale that is scored using a five-item Likert format, ranging from 1 (not at all) to 5 (extremely). Measurement can be either continuous to obtain a symptomatology severity score or categorical. The PCL-M has a diagnostic cutoff point; scores over 50 are considered indicative of PTSD.[34] Cronbach's alpha for this scale has been reported to be $\alpha = 0.96$.[34] To make the PCL-M appropriate for this research effort, the language was altered slightly. Questions 1–8 initially asked respondents about a stressful *military* experience. For this effort, respondents were asked about a stressful *work* experience. Whereas the PCL-M has not been used to assess PTSS in EMTs, it has been used successfully to assess PTSS in military personnel[35–37] and to test the relationship between alcohol use and PTSD in peacekeepers.[38]

Occupational Stress

Given that two types of stress associated with a safety culture may influence stress responses in EMS, it was necessary to select different measures to assess each type of stress individually. While numerous extant measures assess general occupational stress, far fewer measures exist when it comes to assessing chronic and critical incident stress in an environment as specific as EMS. To reflect the idiosyncratic environment of EMS stress, measures were selected from the parallel research literature on police stress reactions.

To assess for chronic stress, the two-part Police Stress Questionnaire (PSQ)[39] was selected. The adapted PSQ examines operational and organizational aspects of police work; each of these two scales has 20 items on a seven-point Likert scale, where 1 = no stress at all, 4 = moderate stress, and 7 = a lot of stress. The PSQ has demonstrated acceptable reliability ($\alpha > 0.90$) in validation samples.[39] To adapt the PSQ scales for use in this study, several changes were made. The language in two items was altered slightly to fit the EMS

population. One item that asked about exposure to traumatic events was removed, as traumatic exposure was dealt with separately in this study.

In contrast to the other measures selected for this effort, no validated measure of critical incident stress is available in the scholarly literature. One instrument, the Critical Incident History Questionnaire (CIHQ),[40] is currently being used in research on police as an index of exposure to critical incidents. The CIHQ, in its original form, is a 34-item measure that asks respondents to report both the number of times they have been exposed to the stressor and how difficult it would be *in their opinion* to cope with each type of incident. The CIHQ was adapted in multiple iterations to suit this research; the process is discussed in greater detail elsewhere.[41] The version of the CIHQ used in this study consisted of 29 items. One major change to the CIHQ in this study involved how respondents were asked about their reaction to the critical incident. Rather than asking about imagined coping, respondents were asked to report their level of stress related to each exposure in the past six months. Respondents answered using the same seven-point Likert scale as the chronic stress questions. This instrument measures self-reported stress associated with specific events, so there is expectation that because respondents were exposed to one event, they would necessarily be exposed to another. Therefore, the CIHQ was treated not as a scale, but rather as a checklist of stressful events.[42]

Demographics

Respondents were asked about age, race/ethnicity, gender, marital status, urbanicity of service area, hours worked weekly, level of training (EMT-Basic, EMT-Intermediate, and EMT-Paramedic), income, and years of experience in EMS.

Study Protocol

The study's sampling frame was a probability sample of EMTs registered with the NREMT. The NREMT provided the names, levels of training, and e-mail addresses of 12,000 nationally registered EMTs and paramedics. Each EMT selected received an introductory e-mail message describing the study purpose and steps for participation. The e-mail message included a hyperlink to the survey. All surveys were administered by commercially available survey software (www.snapsurveys.com). The survey system sent up to two invitations and two reminders at five-day intervals. Participation was voluntary and the respondents had multiple opportunities to opt out of the study.

Analysis of Data

Confirmatory factor analysis (CFA) was used to determine whether the surveys used for this study measured the constructs intended to measure in our sample of EMS workers. The evaluation included four measures of instrument validity (model fit): the root mean square error of approximation (RMSEA), Bentler's comparative fit index (CFI), the Tucker-Lewis index (TLI), and the standardized root mean square residual (SRMR). An RMSEA less than 0.07, a CFI and TLI greater than 0.90, and an SRMR less than 0.08[43–45] are considered indicative of a good model fit. Cronbach's alpha was used to assess for internal consistency (reliability). A Cronbach's alpha score greater than 0.70 is considered an acceptable indicator of reliability.[46,47]

In order to assess the appropriateness of the data for analysis, frequencies, means, and standard deviations were examined. The data were examined for skewness and kurtosis, and residuals were plotted to assess for violations of the assumptions of linear regression. Correlation coefficients were used to assess multicollinearity and the strength of bivariate relationships. Ordinary least squares (OLS) regression was used to examine the association between posttraumatic stress, chronic and critical incidents stress, and alcohol use. Linear regression models were built by introducing the demographic characteristics first, followed by stepped introduction of the predictor variables.

For the purposes of analyses, several categorical demographic variables were recoded dichotomously. Married respondents (married for the first time, married with previous marriages, or living with a partner) were collapsed into a "married" variable and respondents who reported their status as single, divorced or separated, or widowed were recoded as "non-married." While the sampling frame was supposed to contain only EMT-Basics and EMT-Paramedics, 31 individuals identified themselves as certified at the EMT-Intermediate level. These individuals were collapsed into the EMT-Paramedic category. The rationale for this decision was that the higher levels of training and responsibility associated with EMT-Intermediate more closely resemble the characteristics of EMT-Paramedics. Finally, because of the overwhelming proportion of individuals in this sample who were white, all other respondents were collapsed into a "racial/ethnic minorities" category.

RESULTS

Descriptive Results

The descriptive demographic characteristics of the sample are illustrated in Table 1. In order to assess the representativeness of the sample, results are presented in comparison with those of other studies of EMTs and paramedics conducted over the last decade.[23,48–50]

TABLE 1. Demographic Characteristics of the Respondents

	Current Sample $N = 1,633$	Brown et al. 2002[23] $N = 1,790$	National Registry of Emergency Medical Technicians 2006[48] $N = N/R$	Brown et al. 2003[49] $N = 1,704$	Studnek and Fernandez 2008[50] $N = 1,297$
Level of certification					
EMT-Basic	29.8%	49.2%	—	40.9%	30.7%
EMT-Paramedic	70.2%	50.8%	—	59%	64.8%
Gender					
Male					
EMT-B	69.9%	71.2%	64.8%	69%	68.3%
EMT-P	76.1%	69.0%	73%	74%	
Female					
EMT-B	30.1%	—	35.2%	—	31.7%
EMT-P	23.9%	—	27%	—	
Marital status					
Married first time/married with previous marriages					
EMT-B	47.2%	56.3%	—	—	67.8%
EMT-P	56.8%	61.6%	—	—	
Not married, living with partner					
EMT-B	9.7%	4.3%	—	—	
EMT-P	11%	4.9%	—	—	
Widowed					
EMT-B	0.2%	0.2%	—	—	
EMT-P	0.1%	0.8%	—	—	
Divorced/separated					
EMT-B	8.7%	10.4/1.9%	—	—	8.6%
EMT-P	10.6%	8.8/1.7%	—	—	
Never married					
EMT-B	34.2%	28%	—	—	23.6%
EMT-P	21.5%	20.9%	—	—	
Ethnicity					
American Indian/Alaskan Native					
EMT-B	1.3%	2.8%	1.9%	—	—
EMT-P	1.3%	1.5%	2.1%	—	—
Native Hawaiian or Pacific Islander					
EMT-B	1.7%	0.1%	<1%	—	—
EMT-P	0.3%	0.3%	1.3%	—	—
White					
EMT-B	82.3%	90.2%	76%	76%	82.6%
EMT-P	88.4%	92.3%	77.7%	89%	
African American					
EMT-B	1%	2.0%	8.4%	—	—
EMT-P	1%	2.7%	5.6%	—	—
Hispanic/Latino					
EMT-B	6.9%	3.5%	10.8%	—	—
EMT-P	4.8%	2.8%	10.6%	—	—
Asian					
EMT-B	1.9%	1.3%	2.4%	—	—
EMT-P	1.3%	0.5%	2.7%	—	—
More than one race					
EMT-B	5%	—	—	—	—
EMT-P	2.8%	—	—	—	—
	Mean (±SD)	*Mean (±SD)*	*Mean (±SD)*	*Mean (±SD)*	
Age, years					
EMT-B	34.67 (±10.19)	34.9 (N/R)	36.5 (±12.1)	—	—
EMT-P	34.5 (±9.36)	35.1 (N/R)	35.1 (±8.7)	—	—
Length of service, years					
EMT-B	6.0 (±6.8)	2.17 (N/R)	—	4.2 (N/R)	—
EMT-P	10.28 (±7.86)	9.12 (N/R)	—	9.2 (N/R)	—
Hours worked weekly*					
EMT-B	3.39 (±1.47)	—	—	—	—
EMT-P	4.37 (±1.08)	—	—	—	—
Income per year†					
EMT-B	2.78 (±2.01)	$23,350	—	$29,365	—
EMT-P	5.19 (±2.13)	$37,282	—	$39,498	—

*Scoring used for the current study: 1 = <10 hours, 2 = 10 to <20 hours, 3 = 20 to <40 hours, 4 = 40 to <60 hours, 5 = 60 to <80 hours, 6 = 80 to <100 hours, and 7 = ≥100 hours.

†Scoring used for the current study: 1 = <$20,000, 2 = $20,000 to 29,999, 3 = $30,000 to 39,999, 4 = $40,000 to 49,999, 5 = $50,000 to 59,999, 6 = $60,000 to 69,999, 7 = $70,000 to 79,999, 8 = $80,000 to 89,999, 9 = $90,000 to 99,999, and 10 = ≥$100,000.

EMT-B = emergency medical technician–basic; EMT-P = emergency medical technician–paramedic; N/R = not reported; SD = standard deviation.

Several characteristics of the sample are consistent with what is known about the population of EMTs and paramedics in other research efforts. Specifically, the sample is predominantly male (>64%) and white (>76%), with a mean age (in years) in the mid-30s. Although the sampling frame in this study was split evenly between EMT-Basic and EMT-Paramedic, a larger-than-expected proportion of individuals certified at the EMT-Paramedic level responded to the survey; this response proportion is found in other studies. Roughly half of the respondents in three studies reported being married for the first time or married with previous marriages. Slightly more respondents in this population reported living with a partner than in previous studies; this may be an idiosyncrasy of this sample or may be due to the fact that the comparative study was conducted almost 10 years ago and the overall percentage of the cohabiting population is increasing.[51] The average length of service and income were proportionally consistent with those of other studies (paramedics had more time in the field and made more money than EMT-Basics).

Table 2 presents the descriptive analyses of the composite measures. In this sample, 105 respondents (6.4% of the sample) scored at a level that would indicate probable PTSD.

Confirmatory Factor Analysis Fit Indexes

The test of the AUDIT confirmed that the tool had positive psychometric properties in this study sample: RMSEA = 0.05, CFI = 0.97, TLI = 0.97, SRMR = 0.03, and Cronbach's α = 0.80. Tests of the PCL-M also confirmed that the tool had positive psychometric properties in this study sample: RMSEA = 0.07, CFI = 0.94, TLI = 0.92, SRMR = 0.04, and Cronbach's α = 0.93. Tests of the chronic stress scale demonstrated positive psychometric properties: RMSEA = 0.06, CFA = 0.92, TLI = 0.91, SRMR = 0.04, and Cronbach's alpha (organizational stress α = 0.868, operational stress α = 0.877). As this is the first time the chronic stress scale has been used with EMS personnel, the Perceived Stress Scale[52] was used to assess for convergent validity; both chronic stress scales correlated significantly with the Perceived Stress Scale (operational stress: r = 0.44, p < 0.01; organizational stress: r = 0.33, p < 0.01).

TABLE 2. Univariate Analysis of Composite Measures

	n	Mean	(+SD)
Chronic stress—operational	1,582	34.88	(±13.32)
Chronic stress—organizational	1,553	38.98	(±13.39)
Critical incident stress	1,633	28.8	(±25.52)
Posttraumatic stress symptomatology (PCL-M)	1,565	29.67	(±11.23)

PCL-M = PTSD Checklist–Military; PTSD = posttraumatic stress disorder; SD = standard deviation.

The final instrument used in these analyses, the CIHQ, is an inventory of stressful events rather than a scale, and not appropriate for CFA.

Bivariate and Multivariate Analyses

In order to assess the relationship between the variables, bivariate correlations ascertained the strength of the association and assessed for multicollinearity. Posttraumatic stress correlated with critical incident stress (r = 0.386, p < 0.01), with operational chronic stress (r = 0.509, p < 0.01), with organizational chronic stress (r = 0.373, p < 0.01), and with alcohol use (r = .222, p<.01). Critical incident stress correlated with operational chronic stress (r = 0.353, p < 0.01), with organizational chronic stress (r = 0.348, p < 0.01), and with alcohol use (r = 0.087, p < 0.01). Operational chronic stress correlated with organizational chronic stress (r = 0.613, p < 0.01) and with alcohol use (r = 0.055, p < 0.05) and chronic organizational stress correlated with alcohol use (r = 0.039, p = not significant).

Finally, a series of OLS regression analyses were conducted. In the regression of PTSS, the first model introduced the demographic factors, and subsequent models introduced each stress variable. Interaction terms were introduced to further explore the relationships between stressors and posttraumatic stress. The results of the regression analyses are laid out in Table 3.

In model 1, the demographic variables were entered. Length of service (p < 0.01), hours worked (p < 0.001), and income (p < 0.01) demonstrated a significant relationship with posttraumatic stress. Once operational chronic stress was introduced in model 2, demographic factors (with the exception of hours worked) were no longer significant. In model 2, operational chronic stress was a significant predictor of PTSS (p < 0.001). In model 3, organizational chronic stress was also a significant predictor (p < 0.01). In model 4, critical incident stress was a significant predictor (p < 0.001). In model 5, alcohol use became a significant predictor of PTSS (p < 0.001). The inclusion of chronic stress, critical incident stress, and alcohol use improved the explanatory power of the model substantially from an adjusted R^2 of 0.044 in model 1 to 0.334 in model 5. Given the strong bivariate relationships between the stress and alcohol variables with PTSS and previous empirical evidence demonstrating the importance of stress on health-related outcomes, the decision was made to test the interactions of the two types of stress and alcohol use. The interactions between critical incident stress and alcohol use, organizational stress and critical incident stress, and organizational stress and alcohol use were not significant (not shown), the inclusion of operational stress × critical incident stress in model 6 was significant (p < 0.01), increasing the adjusted R^2 of the

TABLE 3. Unstandardized Coefficients from Ordinary Least Squares Regression of Posttraumatic Stress Disorder on Stress and Alcohol Use

	Model 1			Model 2			Model 3			Model 4		
	b	SE	p	b	SE	p	b	SE	p	b	SE	p
(Constant)	–6.328	2.304	0.006	–2.028	2.014	0.314	–1.843	2.008	0.359	–0.438	1.980	0.825
Length of service	0.134	0.051	0.008	0.072	0.044	0.104	0.063	0.044	0.150	0.034	0.043	0.427
Age	–0.051	0.038	0.177	–0.012	0.033	0.723	–0.014	0.033	0.673	–0.004	0.032	0.903
Gender	–0.020	0.680	0.976	–0.887	0.593	0.134	–0.867	0.591	0.142	–0.672	0.580	0.247
Hours worked	1.814	0.270	0.000	0.575	0.243	0.018	0.587	0.242	0.015	0.389	0.239	0.103
Income	–0.493	0.162	0.002	–0.188	0.142	0.185	–0.189	0.141	0.182	–0.167	0.139	0.229
Level of training	1.317	0.720	0.068	1.215	0.627	0.053	1.102	0.625	0.078	0.590	0.618	0.339
Ethnicity	–0.075	0.843	0.929	–0.362	0.734	0.622	–0.336	0.731	0.646	–0.391	0.717	0.586
Marital status	–0.779	0.616	0.207	–0.374	0.537	0.486	–0.287	0.535	0.591	–0.417	0.525	0.428
Chronic stress (op)			0.406	0.020	0.000	0.360	0.024	0.000	0.327	0.024	0.000	
Chronic stress (org)						0.076	0.024	0.001	0.049	0.024	0.038	
Critical incident stress									0.078	0.011	0.000	
Adjusted R^2			0.044			0.277			0.282			0.309
Change in R^2 (vs. model 1)			—			0.232‡			0.006‡			0.027†

	Model 5			Model 6			Model 7		
	b	SE	p	b	SE	p	b	SE	p
(Constant)	–2.186	1.959	0.265	–2.713	1.959	0.166	–2.747	1.952	0.160
Length of service	0.047	0.043	0.274	0.049	0.042	0.249	0.046	0.042	0.277
Age	0.014	0.032	0.653	0.013	0.032	0.683	0.014	0.031	0.664
Gender	–0.041	0.576	0.944	0.034	0.575	0.953	–0.017	0.573	0.976
Hours worked	0.326	0.235	0.164	0.321	0.234	0.169	0.342	0.233	0.143
Income	–0.198	0.136	0.145	–0.178	0.136	0.190	–0.191	0.135	0.158
Level of training	0.508	0.606	0.403	0.539	0.604	0.373	0.553	0.602	0.359
Ethnicity	–0.132	0.705	0.851	–0.082	0.703	0.907	–0.025	0.700	0.971
Marital status	0.440	0.530	0.406	0.471	0.528	0.373	0.439	0.526	0.404
Chronic stress (op)	0.329	0.024	0.000	0.328	0.024	0.000	0.320	0.024	0.000
Chronic stress (org)	0.049	0.023	0.034	0.057	0.023	0.014	0.063	0.023	0.007
Critical incident stress	0.074	0.011	0.000	0.061	0.011	0.000	0.060	0.011	0.000
Alcohol use	0.413	0.058	0.000	0.405	0.058	0.000	0.386	0.058	0.000
Op stress × CI stress				0.002	0.001	0.001	0.002	0.001	0.003
Op stress × alcohol use							0.013	0.004	0.001
Adjusted R^2			0.334			0.338			0.343
Change in R^2 (vs. model 1)			0.025‡			0.005†			0.005†

*$p < 0.05$.
†$p < 0.01$.
‡$p < 0.001$.
CI = critical incident; op = operational; org = organizational; SE = standard error.

model to 0.338 ($\Delta R^2 = 0.005$, $p < 0.01$). The interaction term of operational stress × alcohol use introduced in model 7 was also significant ($p < 0.01$), adding slightly to the overall explanatory power of the model by increasing adjusted R^2 to 0.343 ($\Delta R^2 = 0.005$, $p < 0.01$).

To further explore the interactions included in models 6 and 7, the interactions were graphed by dividing the respondents equally, creating three tertiles of chronic stress and critical incident stress (high, moderate, and low). Tertiles of alcohol use were created using the mean alcohol use score plus or minus one standard deviation. These mean scores were entered into the regression equation separately, yielding three different regression lines.

As seen in Figure 1, chronic operational stress appears to mediate the relationship between critical incident stress and PTSS. The variability in PTSS among those with high levels of critical incident stress is not observed in those with low levels of critical incident stress. Those with high levels of chronic and critical incident stress reported higher rates of PTSS than did those with lower rates of chronic stress; the PTSS scores are similar for those with low critical incident stress, regardless of the reported levels of chronic stress.

Figure 1 also illustrates a similar interaction of chronic operational stress with alcohol use; the relationship between alcohol use and PTSS appears to be mediated by the level of chronic stress. High levels of alcohol consumption and high chronic stress are associated with higher levels of PTSS than with low levels of chronic stress. Among those with low alcohol use, chronic stress does not appear to have the same influence on PTSS, as the scores are all within three-tenths of a point of each other. In this sample, chronic stress demonstrates a synergistic relationship with critical incident stress and alcohol use; individuals reporting

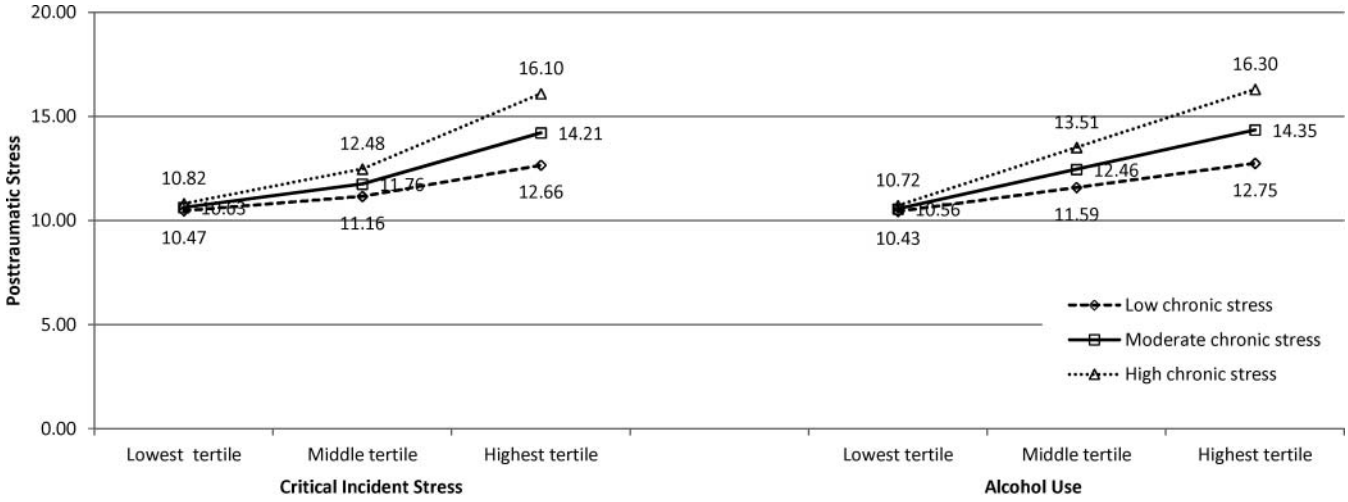

FIGURE 1. Interactions of critical incident stress and alcohol use with chronic operational stress, simultaneous entry in regression of posttraumatic stress symptomatology.

high levels of chronic stress in combination with high levels of alcohol use or critical incident stress report higher rates of PTSS than those with lower levels of chronic stress.

DISCUSSION

Extant studies of PTSD in EMTs and paramedics found rates ranging from 5%[19,53] to 22%.[15,54] Population estimates of PTSD range from 6.8%[55] to 7.8%.[56] In this study, 6.4% of the respondents reported scores on the PCL-M that would indicate PTSD. This finding is substantially lower than those of earlier studies in EMTs. Why would EMTs, who have regular exposure to traumatic stressors, report slightly less pathology than the overall population? The first possibility is that social desirability bias influenced respondents to underreport their symptoms. Anecdotally, the occupational culture in EMS discourages reporting distress, and so respondents may minimize reporting. A second possibility involves the low response rate. Some unobserved difference may exist in levels of pathology between responders and nonresponders. A third possibility may involve a present state bias; those who were more vulnerable to stress reactions may have moved out of the profession, creating a population that has more overall resiliency to traumatic stress than the general population. These explanations are not mutually exclusive; it is possible that they all may influence the findings.

In the regression analyses, PTSS was significantly associated with both chronic and critical incident stress. The findings on stress are not surprising, given the theoretical and empirical evidence linking stress exposures and stress reactions. However, the significant relationship between alcohol use and posttraumatic stress was not predicted by the theoretical model. Several reasons may be posited for this finding. First, individuals consuming alcohol may be more likely to place themselves in hazardous or traumatic circumstances, not because of their occupational environment but because of impaired decision making,[57–59] and increase the chances of developing PTSS. Second, alcohol use may increase vulnerability to PTSS by increasing anxiety, stress, or guilt associated with heavy drinking or cause physiologic reactions (e.g., high levels of ingestion, withdrawal) that leave the individual in a hyperaroused stated and more vulnerable to PTSS.[60,61] A third possibility is that individuals reporting higher rates of alcohol use have a history of previous trauma. Recent research has uncovered evidence of early trauma in EMS; 38.4% of paramedics in one sample reported either physical, emotional, or sexual abuse as children.[62] Other research documented a link between childhood trauma and increased catecholamine response to stress in police officers.[63] Therefore, it is possible that PTSS in this sample may not necessarily be related to workplace trauma. Previous traumatic history was not included in this study, so it becomes a potential confounding variable. All three possibilities are plausible explanations for why alcohol abuse is a significant predictor of PTSS in EMTs.

Additional findings in the regression of PTSS revealed significant interactions between chronic operational stress and critical incident stress and between chronic operational stress and alcohol use. While the introduction of both interaction terms did not increase the explained variance of the model substantially, the results were significant. Graphing of the interaction between predictors suggested that increased chronic stress is associated with both increased critical incident stress and increased alcohol use. For example, individuals with high levels of chronic operational stress report higher levels of critical incident stress and alcohol use, whereas individuals with low levels of chronic

operational stress report about the same levels of critical incident stress and alcohol use as those with low levels of alcohol use and critical incident stress. It must also be noted that the effect ($\Delta R^2 = 0.005$, $p < 0.01$), while significant, was not large. Further research may better illustrate the significance of the interaction of chronic and critical incident stress.

LIMITATIONS

The methodology for this research includes a number of limitations attributable to the study design in self-report research. One limitation exists within the sampling approach. The use of probability sampling is a modest improvement over past efforts that used convenience samples; the sampling frame does not include every individual who is working as an EMT in the United States. Because the NREMT certifies individuals in 45 states, individuals practicing in the states of Delaware, Massachusetts, North Carolina, Wyoming, and New York were not included in the sampling frame. It is possible that individuals within those states voluntarily chose to reregister after their initial two-year certification period with the NREMT. However, an unknown percentage of the population will not reregister. While this is a limitation of the study, the NREMT offers the best sampling frame possible, as it represents more American EMTs than any other organization, and so was the best choice for this study.

Another major limitation in survey research lies in the vulnerability to bias. One such bias is nonresponse bias. This research was designed with the expectation that the response rate would be low. The use of probability sampling was intended to generate a sample population that reflected more accurately the characteristics of the general population, thus increasing the potential for generalizability of the results. The 14% response rate to this survey is lower than desirable, as some unknown differences may exist between individuals who chose to respond to the study and those who did not respond. Given these concerns, it is encouraging that the demographic characteristics of the sample are similar to other data provided by the NREMT. This research may also be vulnerable to social desirability bias,[64,65] wherein individuals report what they think they ought to say rather than what is actually true. This may be particularly problematic in EMTs, because often very little social permission exists to express distress over a gruesome or traumatic patient encounter. If the social environment has taught individuals that it is not acceptable to have reactions to occupationally related stress exposures, individuals may be less willing to admit that they indeed are having reactions, creating a tendency to underreport symptoms and alcohol use. Unfortunately, because of the length of the survey, including a measure to assess the degree to which social desirability influenced responses was not feasible.

The last type of bias that is introduced in self-report surveys deals with recall bias,[66] wherein respondents do not answer questions accurately because too long a period of time has passed, and they do not recall the answers accurately. Because of problems with recall bias, every effort was made to keep the time frame consistent across all the measures to reduce the burden on respondents of attending to different time frames. Additionally, the recall period was relatively recent, as respondents were asked about stress levels in the last six months. This focus on recent events may have failed to differentiate long-term accumulated stress or trauma from recent stress. However, the time frame of the inquiry is consistent with recommendations of six months to one year[42] and was consistent with how the instruments had previously been used in other research, and focusing on recent stress levels was judged to be the best way to minimize the threat posed by recall bias. Despite the limitations of this study, significant findings contribute to the overall understanding of occupationally related stress exposures and stress reactions in EMTs.

CONCLUSIONS

This research demonstrates that there is a link between operational and organizational chronic stress and critical incident stress, alcohol use, and PTSS. These findings can be used on both the individual level and the organizational level. With greater empirical evidence of the impact of occupational stress, individuals may be better able to take steps to reduce the impact of occupational stress. With more of an awareness of the risks associated with the profession, individuals will be better equipped to handle stressors, recognize when they are impaired because of stress, and seek help when needed. Additionally, individual awareness of the impact of occupational stress may lead to an increase in discussion of these issues openly among colleagues, leading to a culture that holds less stigmatized beliefs about stress reactions. At an organizational level, these findings may provide data to medical directors, educators, supervisors, and administrators who may need to address stress in the workplace. With an increased awareness, there may be a greater willingness to look at organizational supports for the mental health of EMS workers. While there is a reasonable level of awareness of critical incident stress in the EMS community, the impact of chronic stress and alcohol use is not as widely identified as a concern. With these findings, emergency services may be able to create better institutional protections for their employees and enact policies to address some of the chronic stressors

that are so influential in increasing the risk for higher levels of posttraumatic stress symptomatology.

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