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Factors Predicting the Development of Psychopathology Among First Responders: A Prospective, Longitudinal Study

Talya R. Feldman and Caryn L. Carlson
University of Texas at Austin

Leslie K. Rice
Baylor College of Medicine

Marc I. Kruse
City of Austin: Austin Fire Department, Austin, Texas, and Austin-Travis County Emergency Medical Services, Austin, Texas

Christopher G. Beevers, Michael J. Telch, and Robert A. Josephs
University of Texas at Austin

Objective: Previous research has shown that first responders exhibit elevated rates of psychopathology. Factors predicting the development of this psychopathology, however, remain understudied. This study longitudinally examined predictors of posttraumatic stress disorder (PTSD), depression, and anxiety symptoms in first responders. ***Method:*** Participants included 135 emergency medical service (EMS) providers. Multiple linear regressions were used to model predictors of change in PTSD, depression, and anxiety symptomatology from baseline to 3-month follow-up. Baseline levels of social support, sleep, emotional stability, and perceived stress were examined as potential predictors. ***Results:*** Results revealed that (a) increases in PTSD symptoms, (b) increases in depression symptoms, and (c) increases in anxiety symptoms at 3-month follow-up were each predicted by worse sleep and lower social support at baseline. In particular, the sleep subscale of disturbed sleep and the social support subscale of appraisal appeared to be driving these effects. ***Conclusion:*** These results highlight the importance of social support and sleep hygiene in protecting against increases in psychopathology symptoms in EMS providers, and set the stage for future interventions to target sleep disturbances and encourage deeper social connections in order to foster resilience in first responders.

Clinical Impact Statement
This study finds that poor sleep hygiene and lower social support are key risk factors for posttraumatic stress disorder, depression, and anxiety symptoms in paramedics and emergency medical technicians. Specifically, having trouble sleeping and not having someone to confide in predict increases in these symptoms 3 months later.

Keywords: first responders, psychopathology, social support, sleep, stress

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Emergency first responders are exposed to highly stressful and often traumatic events at frequencies far beyond that of almost any other occupation (Haugen, Evces, & Weiss, 2012). The nature of the job involves processing rapid influxes of critical information while making life and death decisions, often under extreme time pressure. Perhaps unsurprisingly, therefore, research on firefighters, police officers, and emergency medical service (EMS) providers (paramedics and emergency medical technicians [EMTs]) has consistently found them to exhibit elevated rates of stress-linked psychopathology (Alexander & Klein, 2001; Morganstein, Benedek, & Ursano, 2016). For example, whereas in the general population the 12-month prevalence rate of depression is 7%, the *point prevalence* rate of depression in first responders ranges from 15% to 26% (Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Kleim & Westphal, 2011). Lifetime prevalence rates of PTSD range from 7% to 10% in the general population and 8% to 11% in adults who have been exposed to at least one traumatic event (Kilpatrick, Badour, & Resnick, 2017). In first responders, a

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Talya R. Feldman and Caryn L. Carlson, Department of Psychology, University of Texas at Austin; Leslie K. Rice, Department of Physical Medicine and Rehabilitation, Baylor College of Medicine; Marc I. Kruse, City of Austin: Austin Fire Department, Austin, Texas, and Austin-Travis County Emergency Medical Services, Austin, Texas; Christopher G. Beevers, Michael J. Telch, and Robert A. Josephs, Department of Psychology, University of Texas at Austin.

Correspondence concerning this article should be addressed to Talya R. Feldman, Department of Psychology, University of Texas at Austin, 1 University Station A8000, Austin, TX 78712. E-mail: talya.feldman@utexas.edu

population almost universally exposed to not one, but many traumatic events, lifetime prevalence rates of PTSD range from 11% to 37% (Kleim & Westphal, 2011; Clohessy & Ehlers, 1999; Petrie et al., 2018). Studies of EMS personnel, in particular, have found them to experience higher rates of PTSD than their fire and police counterparts (Berger et al., 2012). In addition, a meta-analysis of EMS providers found that 15% experienced anxiety and 27% general psychological distress (Petrie et al., 2018).

Despite these elevated rates of psychopathology, this population remains critically understudied and our understanding of what factors allow some to exhibit resilience, whereas others develop symptoms of distress, remains limited. By further understanding the factors that both protect from and contribute to the development of psychopathology in this population, the field can work to develop effective training and prevention programs for first responders.

Social Support, Stress, Sleep, and Emotional Stability in First Responders

Although there has been some research designed to examine questions of risk and resilience in first responders, the literature is extremely limited, particularly for EMS providers (Hegg-Deloye et al., 2014). Furthermore, most of the research that has been conducted is cross-sectional, making it difficult to disentangle the influence of psychopathology on risk factors, and vice versa (Wild et al., 2016).

Although limited, the longitudinal, prospective research that does exist for first responders, along with broader theoretical perspectives on PTSD, depression, and anxiety, suggest several factors that may be important in predicting risk and resilience in this population. In particular, social support has been shown to be a robust predictor of mental health in first responders (Kleim & Westphal, 2011; Sattler, Boyd, & Kirsch, 2014). A 2010 meta-analysis found a positive association between social support and mental health in first responders with a medium effect size (r = .27; Prati & Pietrantoni, 2010). In addition, a 2018 meta-analysis found social support in first responders to be negatively associated with anxiety, depression, and psychological distress with medium to large effect sizes (r = .36–.57; Guilaran, de Terte, Kaniasty, & Stephens, 2018). Although these meta-analyses provide compelling evidence for the protective role of social support in first responders, only three studies examined social support in EMS providers specifically and used longitudinal, as opposed to cross-sectional, design.

Sleep disturbances in first responders have also been well documented to be problematic, but little to no research has directly linked this to other mental health outcomes in this population. Because of the nature of their shift schedules, prevalence of sleep disturbance has been reported in as many as 72% of first responders (Courtney, Francis, & Paxton, 2010), and two preliminary, cross-sectional studies have found correlations between disturbed sleep and depression and anxiety (Courtney et al., 2010; Lee, Byun, & Kim, 2013). This is consistent with general epidemiological studies, which estimate that insomnia is comorbid with other psychiatric illnesses in 50–75% of cases, with a particularly strong association to mood and anxiety disorders (Benca, Obermeyer, Thisted, & Gillin, 1992; Eidelman, Gershon, McGlinchey, & Harvey, 2012). In addition, a longitudinal study of EMS providers examined disturbed sleep as an outcome and found that it was predicted by episodes of PTSD or depression over the previous 2 years (Wild et al., 2016). Current theories suggest, however, that the association between sleep disturbances and psychiatric symptoms is bidirectional, such that in addition to being an effect of psychopathology, disturbed sleep can also serve as a risk factor for future development of symptoms (Eidelman et al., 2012). Despite the extremely high rates of sleep disturbance in this population, to our knowledge, no research has prospectively examined the effects of disturbed sleep on the future development of PTSD, depression, or anxiety symptoms in EMS providers.

As a function of their everyday work, elevated levels of stress are also well understood to be a nearly ubiquitous part of life as a first responder, and the association between stress and psychopathology is long established (Dohrenwend, 1998; Kessler, 1997). Aside from the objective stressors inherent in responding to emergencies, much of the research on trauma and stress has focused on the importance of *appraised* or *perceived* stress. For example, a study of nurses and EMS providers found that whereas there was no association between number of stressful incidents and PTSD, the individual's *subjective* response to the stress (i.e., feeling helpless, scared, or horrified) did predict the development of PTSD symptoms (Declercq, Meganck, Deheegher, & Van Hoorde, 2011). Little, however, is known about the way perceived stress interacts with other risk factors to prospectively predict symptoms of psychopathology in this population.

The personality trait of emotional stability, often referred to by its inverse, neuroticism, has also been examined in connection to psychopathology symptoms. However, although extensively linked to depression, generalized anxiety disorder, and PTSD in the general population (Watson, Kotov, & Gamez, 2006), there is limited data on the role of emotional stability or neuroticism in first responders. Cross-sectionally, it has been correlated with PTSD symptoms, hostility, psychological stress, and lower resilience (Psarros et al., 2018; Wagner, Pasca, & Crosina, 2016). To our knowledge, only one study has examined this trait as a longitudinal risk factor, and here it was found to be predictive of future episodes of depression and PTSD in EMS providers (Wild et al., 2016).

In summary, there exists a robust literature on the importance of social support, sleep, perceived stress, and emotional stability as risk factors for psychopathology in the general population and a small, but growing, body of literature on their role in first responders. Nevertheless, a number of gaps remain in this literature, and as such, our understanding of mental health risk in first responders remains incomplete. First, the vast majority of this literature is based on correlational, cross-sectional findings. Thus, more longitudinal research on the predictive impact of these factors is needed to better understand the causal role of these factors in mental health outcomes among first responders. Second, no research has examined these predictors within the same models in order to account for shared variance and examine which combination of these predictors best accounts for future mental health symptoms in this population. Third, little to no research exists on whether these predictors differentially predict PTSD, depression, and anxiety symptoms in first responders. Fourth, to our knowledge, no research has examined whether certain subcomponents of these factors are particularly important in accounting for risk or resilience.

The current study examines how risk factors of social support, sleep, perceived stress, and emotional stability predict changes in PTSD, depression, and anxiety symptoms in EMS providers. Based on previous, primarily cross-sectional findings, we predict that these factors will each significantly correlate with psychopathology symptoms in EMS providers cross-sectionally. To extend these findings, we use a prospective, longitudinal design to explore which combination of these factors comprises the optimal model for predicting changes in symptoms over time. Finally, in an exploratory manner, we examine the relative contributions of subscales within each significant predictor. Our hope is that these findings will extend our understanding of the factors that put first responders at risk for developing symptoms of psychopathology.

Method

Participants

Participants ($n = 135$) were recruited via convenience sampling from a large emergency medical service. The sole inclusion criterion for this study was current employment by the city EMS department. At the time of recruitment, there were 386 first responders in the department; 375 of them attended one of the CE sessions where information about this study opportunity was presented. Of those, 221 initially consented to the study, representing 58.9% of responders present at the CEs and 57% of the department. Of those 221, 135 completed measures at both baseline and follow-up, representing 35% of those present at the CEs and 36% of the department. Participants did not receive any incentives or payment for participating in the study. The final sample was predominantly Caucasian (90%) and male (78%) with a mean age of 35.63 ($SD = 8.24$); 42% of the sample attended some college with no degree, 28% earned an associate degree, 25% earned a bachelor's degree, and 5% attended some graduate school or earned a graduate degree. Fifteen percent of the sample had been in the job for less than 1 year, 17% for 1–3 years, 8% for 4–5 years, 25% for 6–10 years, 26% for 11–15 years, 6% for 16–20 years, and 2% for more than 20 years.

Procedure

To recruit participants, researchers presented study information at seven mandatory staff continuing education (CE) meetings. Interested participants were invited to stay immediately afterward to complete in-person measures. Online follow-up measures were collected via Qualtrics 3 months later. This research protocol was approved by the University of Texas at Austin Human Subjects Review Board, IRB Protocol # 2013–03-0059.

Measures

Social support. Social support was measured using the 12-item Interpersonal Support Evaluation List, a measure of perceived quality of relationships and support (Cohen & Hoberman, 1983). It uses a 4-point Likert scale (scores 0–36) and has a three-factor structure measuring availability of someone to confide in (appraisal), do activities with (belonging), and provide material aid (tangible). The scale shows high internal reliability (Cronbach's = .86).

Sleep. Sleep was measured using the Pittsburgh Sleep Quality Index, a 19-item self-report measure that asks participants about seven constructs: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications, and daytime dysfunction (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The scale shows internal reliability (Cronbach's = .83) and high test–retest reliability.

Emotional stability. This trait was assessed using the emotional stability subscale of the Ten Item Personality Inventory. The Ten Item Personality Inventory uses a 7-point Likert scale to measure the "Big Five" personality domains of extraversion, agreeableness, conscientiousness, emotional stability, and openness (Gosling, Rentfrow, & Swann, 2003). It shows adequate convergent and discriminant validity, and adequate test–retest reliability (Gosling et al., 2003).

Stress. The Perceived Stress Scale (PSS) was used to measure overall subjective stress (Cohen, Kamarck, & Mermelstein, 1983). This 10-item measure, with scores ranging from 0 to 40, assesses the degree to which recent life events have been appraised as stressful.

PTSD. Symptoms of PTSD were assessed using the Civilian PTSD Checklist (PCL-C; Weathers, Litz, Herman, Huska, & Keane, 1993). This 17-item checklist corresponds to *DSM–IV* and consists of three clusters: reexperiencing, avoidance, and hyperarousal over the past month. The PCL-C uses a 5-point Likert scale, has scores ranging from 17 to 85, and demonstrates high internal consistency (Cronbach's = .94).

Depression. Symptoms of depression were assessed using the 10-item Center for Epidemiological Studies Depression Scale (CES-D), which has individuals rate the frequency of symptoms over the past week on a Likert scale from 0 to 3. (Andresen, Malmgren, Carter, & Patrick, 1994). Scores range from 0 to 30, and it shows internal reliability (Cronbach's = .86) and high test–retest reliability.

Anxiety. Symptoms of anxiety were measured using the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). This 21-item inventory asks participants to rate the frequency with which they have experienced common symptoms of anxiety over the past month on a Likert scale from 0 to 3. It has scores ranging from 0 to 63 and has shown strong internal consistency (Cronbach's = .75) and test–retest reliability ($r = .75$).

Data Analysis Plan

First, zero-order correlations were calculated between all variables of interest. Second, ordinary least squares (OLS) multiple linear regression was used to model variance in (a) PTSD, (b) depression, and (c) anxiety symptoms at baseline. OLS multiple linear regression was next used to model changes in (a) PTSD, (b) depression, and (c) anxiety symptomatology from baseline to 3-month follow-up. In this set of analyses, baseline levels of social support, sleep, emotional stability, and perceived stress were entered into the model as predictors and baseline symptom levels were used as control variables. Finally, to examine whether specific components of sleep and social support were driving the results, OLS multiple linear regressions were conducted with the subscales of each measure as predictors.

For every set of regression analyses, the choice of final models was guided by the Akaike information criterion (AIC; Bozdogan,

1987). The AIC, as opposed to adjusted R^2, was used as the decision point as it provides a stricter cutoff for predictor inclusion, thus reducing Type I error likelihood. See Supplement A in the online supplemental materials for all models considered. Regression diagnostics revealed that the assumptions of linear regression models were met, except that in roughly half of cases, residuals were not normally distributed. This finding is not unexpected, given the inherently skewed nature of the outcome variables. To address this, we repeated the regression analyses using nonparametric bootstrapping, as a validation check. In all cases, bootstrapping confirmed the results of OLS regression. Power analyses revealed that this study had sufficient power (0.86) to detect small-medium effects ($f^2 = 0.07$) in a two-tailed linear multiple regression model with five predictors.

Results

Data were checked for abnormal values, outliers, and expected ranges. Using listwise deletion, participants who only completed baseline measures ($n = 69$) were removed from the analysis, leaving a final sample size of 135. The only outliers removed were for data entry errors (i.e., impossible values). To test for the possibility that significant differences exist between those who completed the follow-ups and those who did not, we conducted independent samples *t* tests and chi-squared tests to compare these two groups at baseline. We found no significant between-groups differences on age, race, ethnicity, or PTSD, depression, or anxiety symptom levels. Gender was the only variable that significantly predicted completers versus dropouts, with a higher dropout rate among females. Gender did not predict any other outcomes (see Supplement B in the online supplemental materials for attrition analyses). Data analyses were conducted in R.

Descriptive statistics and zero order correlations are in Table 1. All variables of interest were significantly correlated with one another with effect sizes ranging from 0.30 to 0.71. See Supplement C in the online supplemental materials for means and clinical cutoffs for PTSD, depression, and anxiety scores.

Baseline Association Models

PTSD. Using the model selection criteria described above, PTSD symptoms at baseline were best accounted for by a model including sleep, perceived stress, and social support. The overall model accounted for 60.9% of the variance in PTSD, $F(3, 99) = 51.34$, $p < .001$. For individual predictors, poorer sleep, higher perceived stress, and lower social support were each significantly associated with greater PTSD symptoms.

Depression. Depression symptoms at baseline were best accounted for by a model that included sleep dysfunction, perceived stress, and social support. The overall model with all three variables accounted for 45.1% of variance in depression, $F(3, 99) = 27.06$, $p < .001$. For individual predictors within the model, poorer sleep quality and higher perceived stress were significantly associated with higher levels of depression.

Anxiety. Anxiety symptoms at baseline were best accounted for by a model that included sleep dysfunction, perceived stress, social support, and emotional stability. The overall model with all four variables accounted for 46.6% of variance in anxiety, $F(3, 98) = 21.36$, $p < .001$. For individual predictors within the model, worse sleep hygiene, greater perceived stress, and lower emotional stability each accounted for increased anxiety scores. See Table 2 for a summary of PTSD, depression, and anxiety regression models.

Predictors of Changes in PTSD, Depression, and Anxiety From Baseline to Follow-Up

PTSD. Using the model selection criteria described above, change in PTSD symptoms from baseline to 3-month follow-up was predicted by sleep dysfunction and social support, with baseline level of PTSD as a control variable. The overall model accounted for 62.8% of the variance in PTSD symptoms, $F(3, 99) = 55.79$, $p < .001$. In terms of individual predictors, poorer sleep quality and lower social support at baseline were each significantly associated with changes in PTSD symptoms 3 months later.

Depression. Change in depression symptoms from baseline to 3-month follow-up was best predicted by a model with sleep quality and social support as predictors, and baseline level of depression as a control variable. The overall model accounted for 40.4% of the variance in depression, $F(3, 99) = 22.39$, $p < .001$. For individual predictors within the model, poorer sleep quality and lower social support at baseline were significantly associated with changes in depression symptoms 3 months later.

Anxiety. Change in anxiety symptoms from baseline to 3-month follow-up was predicted by sleep quality and social support, with baseline level of anxiety as a control variable. The overall model accounted for 58.7% of the variance in anxiety symptoms, $F(3, 99) = 46.81$, $p < .001$. For individual predictors within the model, poorer sleep quality and lower social support at

Table 1
Correlation Matrix and Descriptive Information for Primary Variables of Interest at Baseline

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. PTSD symptoms at baseline	29.67	11.81							
2. Depression symptoms at baseline	10.61	3.67	0.71***						
3. Anxiety symptoms at baseline	6.92	6.41	0.70***	0.63***					
4. Perceived stress	15.18	6.88	0.69***	0.56***	0.58***				
5. Sleep dysfunction	8.52	4.12	0.56***	0.51***	0.47***	0.45***			
6. Social support	40.26	6.66	−0.48***	−0.38***	−0.33***	−0.50***	−0.30**		
7. Emotional stability	5.33	1.29	−0.47***	−0.41***	−0.44***	−0.52***	−0.31**	0.47***	

Note. PTSD = posttraumatic stress disorder.
** $p < .01$. *** $p < .001$.

Table 2
Multiple Linear Regression Output for PTSD, Depression, and Anxiety at Baseline

Outcome	Variable	β	Standard Error	*T*-value	*p*-value
PTSD at baseline	Sleep dysfunction	.30	0.07	4.17	<.001***
	Perceived stress	.50	0.08	5.92	<.001***
	Social support	−.21	0.07	−2.64	.010**
Depression at baseline	Sleep dysfunction	.35	0.09	4.02	<.001***
	Perceived stress	.38	0.10	3.83	<.001***
	Social support	−.14	0.09	−1.53	.129
Anxiety at baseline	Sleep dysfunction	.25	0.08	2.93	.004*
	Perceived stress	.45	0.10	4.42	<.001***
	Social support	.05	0.10	0.48	.630
	Emotional stability	−.22	0.10	−2.17	.032*

Note. PTSD = posttraumatic stress disorder.
* $p < .05$. ** $p < .01$. *** $p < .001$.

baseline were each associated with changes in anxiety symptoms 3 months later. See Table 3 for a summary of PTSD, depression, and anxiety regression models.

In summary, we found that at baseline (a) PTSD symptoms were best accounted for by a model that included sleep dysfunction, social support, and perceived stress; (b) depression symptoms were also best accounted for by a model that included sleep dysfunction, social support, and perceived stress; and (c) anxiety symptoms were best accounted for by a model that included sleep dysfunction, social support, perceived stress, as well as emotional stability. At 3-month follow-up, we found that increases in all three outcomes (PTSD, depression, and anxiety symptomatology) were predicted by baseline sleep and social support. We next examined the unique contributions of subscales within each of these two predictors.

Subscale Analyses

Sleep subscales. To examine the relative contributions of the seven validated Pittsburgh Sleep Quality Index subscales on changes in PTSD symptoms, the seven subscales were entered into a multiple linear regression model which included baseline social support and baseline PTSD symptoms as control variables. Higher scores on the sleep disturbance subscale at baseline significantly predicted increases in PTSD symptoms 3 months later. No other subscales accounted for significant variance in PTSD. For depression symptoms at 3-month follow-up, the seven subscales were entered into a model that included baseline social support and depression symptoms as covariates. As with changes in PTSD symptoms, only sleep disturbance predicted increases in depression. Finally, for anxiety symptoms at 3-month follow-up, all 7 subscales were entered into a model that included social support and baseline anxiety symptoms. Greater sleep disturbance and increased medication use predicted increases in anxiety symptoms. See Table 4 for a summary of regression results.

Social support subscales. To examine the relative contributions of the three validated social support subscales on changes in PTSD symptoms, the three subscales were entered into a multiple linear regression model which included baseline sleep dysfunction and baseline PTSD symptoms as control variables. Lower scores on the appraisal subscale were significant in accounting for increases in PTSD symptoms, and no other subscales explained variance in PTSD. For depression symptoms at 3-month follow-up, the social support subscales were entered into a model that included baseline sleep and baseline depression symptoms, and only lower appraisal was marginally significantly associated with increases in depression symptoms. Finally, for anxiety symptoms at 3-month follow-up, the social support subscales were entered into a model that included baseline sleep and baseline anxiety symptoms as covariates, and only lower appraisal marginally significantly accounted for increases in anxiety. See Table 5 for a summary of regression results.

Table 3
Multiple Linear Regression Output for PTSD, Depression, and Anxiety at 3-Month Follow-Up

Outcome	Variable	β	*SE*	*T*-value	*p*-value
PTSD at 3 months	PTSD at baseline	.60	0.09	6.97	<.001***
	Sleep dysfunction	.16	0.08	2.06	.042*
	Social support	−.19	0.08	−2.42	.018*
Depression at 3 months	Depression at baseline	.37	0.10	3.86	<.001***
	Sleep dysfunction	.20	0.09	2.10	.038*
	Social support	−.23	0.09	−2.54	.013*
Anxiety at 3 months	Anxiety at baseline	.54	0.08	6.98	<.001***
	Sleep dysfunction	.22	0.08	2.88	.005**
	Social support	−.20	0.07	−2.73	.007**

Note. PTSD = posttraumatic stress disorder.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4
Regression Output for Analysis of Sleep Disturbance Subscales

Outcome	Variable	β	*p*-value	R^2
PTSD at 3 months	PTSD at BL	.54	<.001***	0.70
	Social support	−.15	.055	
	Sleep disturbance	.30	<.001***	
	Sleep latency	.08	.280	
	Sleep duration	−.02	.827	
	Habitual sleep efficiency	−.08	.247	
	Sleep quality	−.03	.685	
	Medication	.03	.619	
	Days of Dysfunction	.10	.188	
Depression at 3 months	Depression at BL	.39	<.001***	0.43
	Social support	−.18	.070	
	Sleep disturbance	.19	.032*	
	Sleep latency	.02	.876	
	Sleep duration	.01	.927	
	Habitual sleep efficiency	−.07	.486	
	Sleep quality	.002	.189	
	Medication	.07	.407	
	Days of dysfunction	.10	.296	
Anxiety at 3 months	Anxiety at BL	.51	<.001***	0.64
	Social support	−.18	.023*	
	Sleep disturbance	.24	.001**	
	Sleep latency	.07	.399	
	Sleep duration	.02	.847	
	Habitual sleep efficiency	−.03	.649	
	Sleep quality	−.06	.482	
	Medication	.14	.048*	
	Days of dysfunction	.07	.439	

Note. PTSD = posttraumatic stress disorder; BL = baseline.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In summary, we found that the subscale of sleep disturbance was significantly driving the effect of sleep on symptoms of PTSD, depression, and anxiety. Medication usage appeared to also contribute to the effect of sleep on anxiety symptoms. In terms of social support, the appraisal subscale was significantly driving the effect on PTSD and marginally significant for anxiety and depression. No other social support subscale appeared to be driving these effects.

Discussion

The objective of this study was to examine the potential role of individual, person-specific factors in a longitudinal model of psychopathology risk in EMS providers. Our primary finding was that low levels of social support and poor sleep at baseline were associated with increases in PTSD, depression, and anxiety symptoms 3 months later.

Table 5
Regression Output for Analysis of Social Support Subscales

Outcome	Variable	β	*p*-value	R^2
PTSD at 3 months	PTSD at BL	.61	<.001***	0.63
	Sleep dysfunction	.13	.094	
	Appraisal social support	−.20	.023*	
	Belonging social support	−.003	.974	
	Tangible social support	−.01	.884	
Depression at 3 months	Depression at BL	.40	<.001***	0.41
	Sleep dysfunction	.16	.082	
	Appraisal social support	−.20	.051	
	Belonging social support	−.11	.344	
	Tangible social support	.05	.679	
Anxiety at 3 months	PTSD at BL	.55	<.001***	0.60
	Sleep dysfunction	.20	.007**	
	Appraisal social support	−.15	.073	
	Belonging social support	.06	.490	
	Tangible social support	−.15	.137	

Note. PTSD = posttraumatic stress disorder; BL = baseline.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Previous research in the general population has consistently found social support, sleep, emotional stability, and perceived stress to each play an important role in psychopathology development (Benca et al., 1992; Brewin, Andrews, & Valentine, 2000). Although limited and largely cross-sectional, preliminary research on EMS providers has similarly suggested that these predictors are also important in this population. In line with these findings, when we examined these predictors at baseline as zero order correlations, we, too, found that higher perceived stress and lower social support, sleep, and emotional stability were each correlated with greater symptoms of PTSD, depression, and anxiety.

Examining semipartial correlations at baseline in order to better account for shared variance between variables, however, we found that the best models for explaining variance are somewhat narrower. Both PTSD and depression symptoms at baseline are best accounted for by a model that includes social support, sleep, and perceived stress. Anxiety symptoms at baseline are best accounted for by a model that includes social support, sleep, perceived stress, and emotional stability. The fact that social support, sleep, and perceived stress were included in each of these final models extends previous cross-sectional findings of zero order correlations by showing that even when accounting for the shared variance of these predictors, all three remain correlated with symptoms of psychopathology. Of note, PTSD, depression, and anxiety were all highly correlated with each other (effect sizes ranged from 0.63–0.71), which may also account for the fact that they were correlated with similar variables.

The fact that emotional stability is only included in the model for anxiety, and not in models of depression or PTSD, is somewhat unexpected given that this trait has been broadly linked to psychopathology. Furthermore, emotional stability only makes a very small contribution to the model of anxiety, increasing the R^2 from 44.01 to 46.58. This may be due, in part, to the fact that EMS workers in this sample had higher and more homogeneous scores on emotional stability than the general population, thus restricting variability in the predictor. The mean emotional stability score in our sample is 5.33 (SD = 1.29), whereas the mean for general adults 21–60 ranges from 4.09 (SD = 1.45) to 4.8. (SD = 1.38; Gosling, Rentfrow, & Potter, 2014). Considering the scale maximum score of 7, this skewed range may be contributing to this pattern. High levels of emotional stability are unsurprising in this population given that remaining calm and emotionally stable in a crisis is key in this line of work. Nevertheless, given the novelty of this finding, replication is essential before firm conclusions can be drawn. Future research should examine whether this finding of high levels of emotional stability and lack of predictive power holds in first responders more broadly.

What makes the current dataset unique derives from our ability to examine these predictors prospectively. In doing so, we found that worsening symptoms of PTSD, depression, and anxiety were all significantly predicted by social support and sleep dysfunction, with effect sizes ranging from 0.15 to 0.22. Thus, higher levels of social support and better sleep hygiene at baseline were protective against increases in symptoms 3 months later. This finding is consistent with literature that shows sleep and social support to be longitudinally predictive of psychopathology symptoms in the general population (Benca et al., 1992; Brewin et al., 2000) and extends the extremely limited research on their longitudinal role in paramedics and EMTs.

In contrast to sleep and social support, perceived stress and emotional stability at baseline were not included in the final prospective models and did not significantly predict changes in PTSD, depression, or anxiety longitudinally. This finding is important, first, from a methodological perspective. It emphasizes the importance of longitudinal approaches to studying psychopathology as factors that may appear significant cross-sectionally, may not actually be predictive of future symptoms.

For example, although we found perceived stress to be consistently correlated with symptoms of psychopathology at baseline, it was not a significant predictor prospectively. When looking prospectively and accounting for shared variance among predictors, social support and sleep better predict symptoms of PTSD, depression, and anxiety than does perceived stress. This suggests that perceived stress is perhaps a better *reflection* of current psychopathology than predictor of future psychopathology.

This finding is somewhat surprising given the extensive literature on the importance of stress as a *predictor* of psychopathology in the general population (Kessler, 1997). One potential explanation for this is that the PSS may not be the best measure of stress *in this specific population*. Given that the PSS is a general measure of perceptions of stress, and that stressors in this population are unique, perhaps a different measure is needed to better capture variations in stress in this population and the way this stress relates to future symptoms of psychopathology.

Sleep and Social Support Subscales

To explore whether specific components of sleep and social support have disproportionate effects on psychopathology, we examined the subscales within each of these measures. Within the sleep measure, *only* the subscale of disturbed sleep was significantly predictive of depression or PTSD symptoms 3 months later. Disturbed sleep and, to a lesser extent, medication use, were the only subscales significantly predictive of anxiety symptoms 3 months later. Disturbed sleep is a measure of how frequently over the past month individuals report having "trouble sleeping" due to a list of reasons ranging from feeling hot to having bad dreams (Buysse et al., 1989). One of the challenges facing first responders is that they often work overnight shifts and have rotating schedules, making it difficult to sleep say, a consistent 8 hr every night. Changing this shift style of work would be extremely difficult within the current structure of emergency response centers, and fortunately these findings suggest that may not be necessary. These findings suggest that it is not the objective number of hours slept or even sleep efficiency that matters most. Rather, it appears that it is subjectively feeling that you have had trouble sleeping that predicts psychopathology. This finding is clinically relevant in that it suggests that first responders do not necessarily need different schedules, but instead may benefit from sleep hygiene interventions and tools to reduce difficulties falling and staying asleep.

For social support, *only* the appraisal subscale predicted psychopathology symptoms. This subscale measures the extent to which individuals have someone to confide in about their problems. Whereas other subscales measure tangible support or having friends to see a movie with, it appears that it is this deeper emotional connection that is protective against psychopathology. It remains to be seen whether education around the importance of not

just social interactions, but deeper emotional relationships could improve symptoms of psychopathology in this population.

Limitations

One major limitation of this study is the variability in job tenure among our participants, which ranges from 3 months to over 20 years. Furthermore, given that most respondents had been on the job for many years, the average change in psychopathology symptoms over the 3 months of study was fairly small, with most of the variance in follow-up psychopathology scores explained by baseline scores of psychopathology. With only small changes in symptoms, our ability to fully assess risk and resilience factors was severely limited. In addition, although well powered to detect small to medium effects, this study would have been underpowered to detect the presence of very small effects. We also experienced attrition rates of 33% at 3-month follow-up. At baseline, there appeared to be no significant difference between those who completed the follow-up and those who did not. Nevertheless, it is possible that the noncompleters represent a distinct population not captured by these data. Finally, this study did not control for work-related critical incidents (i.e., a mass casualty event, death of a fellow first responder, etc.) and, therefore, we are unable to examine the role of such events in explaining changes in psychopathology.

Conclusion

The current longitudinal study examined risk for, and resilience to, psychopathology symptoms in a sample of EMS providers. Results suggest that sleep hygiene and social support are key in protecting against increases in symptoms of PTSD, depression, anxiety. Specifically, subjective sleep disturbances appear to put first responders at risk, whereas social support in the form of emotional connections and counsel appears protective. In light of these findings, future studies should examine whether interventions targeting sleep disturbances and encouraging deeper social connections can be utilized to protect against increases in symptoms of PTSD, depression, and anxiety.

Despite the fact that elevated rates of psychopathology have been well established in the EMS population, our understanding of individual risk factors remains incomplete, with first responders continuing to suffer from stress-related psychopathology at rates far higher than in the general population. This study contributes important information to our understanding of risk in first responders, but much work remains to further explicate the factors that put first responders at risk and how best to intervene to strengthen resilience in this important population.

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