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Sleep, resilience, and psychological distress in United States military Veterans

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Abstract

Sleep problems are prevalent among Veterans. Left untreated, such problems may elevate psychological distress and increase risk of subsequent mental health disorders. Psychological resilience may buffer against negative psychological outcomes, yet the relationship between sleep and resilience has not been studied. This study explored poor sleep, resilience, and psychological distress using questionnaires collected as part of the Study of Post-Deployment Mental Health. Participants ($N = 1,118$) had served in the US military since September 11, 2001, had one or more overseas deployments, and were free from a past-month *DSM*-defined mental health disorder. Hierarchical linear regression was used to examine the association between poor sleep quality (Pittsburgh Sleep Quality Index total score) and psychological distress (Global Symptom Index; Symptom Checklist-90-R), controlling for demographic and health characteristics. Moderation analyses tested for a potential buffering effect of resilience (Connor-Davidson Resilience Scale). Poor sleeping Veterans had worse physical and psychological health, lower resilience, and endorsed more lifetime traumatic events. Poor sleep was associated with greater psychological distress controlling for health and demographic characteristics. Both resilience factors—adaptability and self-efficacy—had significant buffering effects on the relationship between poor sleep and psychological distress, suggesting that resilience may protect

against negative outcomes in poor sleepers. Additional research is warranted to better understand the relationships between sleep, resilience, and psychological distress. Such research may inform pertinent prevention efforts, including interventions that improve sleep, enhance resilience, and protect against incident mental health diagnoses.

Keywords

Sleep; mental health; stress; resilience; coping

What is the public significance of this article?—

This study suggests that factors of psychological resilience – adaptability and self-efficacy – may help protect against psychological distress in military Veterans with clinically significant poor sleep. These findings suggest that interventions to improve sleep and enhance resilience may help protect against subsequent psychological distress.

Introduction

The high rates of mental health diagnoses among US military Veterans have garnered significant research and clinical attention. Approximately one-third of Veterans who served in Afghanistan (Operation Enduring Freedom [OEF]) or Iraq (Operation Iraqi Freedom [OIF]) received at least one mental health diagnosis upon returning home, the most common conditions being posttraumatic stress disorder (PTSD) and major depressive disorder (Seal et al., 2009). Sleep problems are a core presenting symptom of many mental health disorders, including PTSD and depression (American Psychiatric Association, 2013). In fact, Veterans with comorbid insomnia and PTSD are partially responsible for a sharp increase in sleep disorders among Veterans Health Administration (VHA) users since 2000 (Alexander et al., 2016; Luxton et al., 2011). Sleep problems and mental health problems are associated with impaired function (Killgore, Balkin, & Westens, 2006; Killgore et al., 2008; Magruder et al., 2004; Pilcher & Huffcutt, 1996), increased healthcare costs and utilization (Calhoun, Bosworth, Grambow, Dudley, & Beckham, 2002; Cohen et al., 2009; Wickwire, Shaya, & Scharf, 2016), and reduced quality of life (Dobie et al., 2004; Katz & McHorney, 2002).

Although sleep problems commonly co-occur with mental health disorders, Ulmer et al. (2015) found that more than two-thirds of OEF/OIF Veterans who returned home without a current mental health disorder also endorsed insomnia complaints including trouble falling or staying asleep. Longitudinal research has found that chronic sleep problems predict incident mental health diagnoses, including PTSD, depression, and anxiety (Baglioni et al., 2011; Breslau, Roth, Rosenthal, & Andreski, 1996; Ford & Kamerow, 1989; Gehrman et al., 2013; Szklo-Coxe, Young, Peppard, Finn, & Benca, 2010; Wright et al., 2011). Despite these patterns, few efforts have focused on protective factors that may prevent both sleep problems and psychological distress from escalating, nor have studies focused on whether early detection and treatment of sleep problems in military Veterans may prevent, or delay, negative outcomes.

As posited by the 3P Model of Insomnia (Spielman & Glovinsky, 1991), sleep problems are triggered by a stressful life event that can contribute to difficulty falling or staying asleep. Ongoing reintegration stressors including coping with deployment-related physical and psychological injuries, navigating family roles and responsibilities, and securing employment may trigger sleep problems (Bramoweth & Germain, 2013). These same sleep problems may then add to, or exacerbate, existing stress. In fact, qualitative research has identified stress and sleep problems as frequent psychosocial issues among returning OEF/OIF Veterans (Strong et al., 2014). The concept of resilience as a psychological construct has been invoked to explain positive health outcomes in the face of stress (Hoge, Austin, & Pollack, 2007; Garmezy, 1971; Werner, 1995). Military researchers have focused on the buffering nature of resilience in protecting against PTSD in Veterans who have experienced early-life trauma and/or combat exposure (Green et al., 2014; Pietrzak et al., 2010; Pietrzak, Johnson, Goldstein, Malley, & Southwick, 2009; Pietrzak, Russo, Ling, & Southwick, 2011). However, to date, no research has examined whether greater resilience protects against psychological distress in the presence of sleep problems. For the purpose of this study, *resilience* is defined as positive stress-coping ability, a modifiable characteristic that is part of a dynamic process contributing to the maintenance of psychosocial homeostasis (Connor & Davidson, 2003).

Prior research with military Veterans identified two key factors of resilience—adaptability and self-efficacy (Green et al., 2014). Both factors may also be key to successfully coping with sleep disturbance and maintaining healthy sleep behaviors. An inability to cope with an initial stressor or adapt to the consequences of such stressors, including difficulty falling or staying sleeping, can lead to unhealthy sleep behaviors, including irregular sleep schedules and poor sleep hygiene (Spielman & Glovinsky, 1991). The ability to maintain healthy sleep habits in the presence of ongoing physical, psychological, or environmental stressors may be associated with an individual's health-related self-efficacy, or the "confidence in one's ability to take action" (Champion & Sugg Skinner, 2008). Together, higher levels of adaptability and/or self-efficacy increase the likelihood of positively adapting to poor sleep, thereby reducing the risk of developing chronic sleep problems which may contribute to subsequent psychological distress (see Figure 1).

This study aimed to address gaps in the literature by examining the relationship between poor sleep, resilience, and psychological distress. More specifically, this study (1) compared the demographic, physical, and psychological characteristics of individuals with and without clinically significant poor sleep quality among Veterans without a current mental health disorder; (2a) examined the degree to which poor sleep contributed to increased psychological distress controlling for health and demographic characteristics; and (2b) examined whether resilience factors (i.e., self-efficacy and adaptability) moderated the relationship between poor sleep and psychological distress. We hypothesized that poor sleep would be significantly positively associated with older age and higher levels of combat exposure, negatively associated with physical and psychological health, and would independently predict levels of psychological distress controlling for health and demographic characteristics. We further hypothesized that greater resilience (i.e., adaptability and self-efficacy) would be negatively associated with levels of psychological

distress and would buffer against greater psychological distress in the presence of poor sleep, as indicated by a significant interaction effect.

Methods

Participants and procedures

Data were drawn from a multi-site volunteer research study sponsored by the Veterans Affairs (VA) Durham VA Medical Center Mental Illness Research, Education, and Clinical Center (MIRECC). The overarching goal of the Post-Deployment Mental Health Study was to examine post-deployment health and adjustment in post-9/11 Veterans. Volunteers were widely recruited throughout four VA Medical Centers in the via flyers, mailings, and provider referrals. Recruitment efforts did not target particular demographic or clinic groups and, instead described the study as looking at “the effects of recent military deployments on the mood, emotions, and mental, and physical health of military personnel” or “the effects of recent deployments on the physical and mental health of service members, especially as they transition from deployment back to civilian life.”

Individuals were eligible to participate if they served in the US military after September 11, 2001, spoke English, were able to travel to one of the study enrollment sites, and demonstrated an understanding of the informed consent process. Institutional review board approval was obtained at each of the four enrollment sites and all participants provided written informed consent. All participants underwent a day-long assessment of demographics, trauma history, sleep patterns, and physical and psychological health. Participants also completed an in-person structured clinical interview. All participants were compensated \$175 for their participation and were provided with a summary of their results if desired. Data presented here were collected between 2005 and 2015. The analytic sample for the current study consisted of 1,118 Veterans who had completed one or more overseas deployments, and who did not meet criteria for one or more mental health disorders (major depressive, posttraumatic stress, anxiety, panic, bipolar, mood, or psychotic disorder) or substance dependence disorders in the month prior to study enrollment, per the Structured Clinical Interview for *DSM-IV* Disorders (SCID; First, Spitzer, & Gibbon, 1994).

Measures

Major variables of interest

Sleep.: The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is an 18-item self-report questionnaire of sleep characteristics over the past month. The PSQI includes items related to sleep duration, sleep disturbances, daytime dysfunction, sleep quality, and use of sleep medications. Total scores range from 0 to 21 with scores greater than five indicate clinically significant poor sleep. The PSQI has demonstrated strong reliability in a range of medical and clinical populations (Cronbach’s alpha 0.81 to 0.83; Buysse et al., 1989; Carpenter & Andrykowski, 1988). In addition to the original scale, the PSQI-Addendum (PSQI-A) is a 10-item self-report measure that assesses the frequency and severity of sleep complaints related to trauma and/or PTSD, including nightmares. The PSQI-A has demonstrated strong internal consistency (Cronbach’s alpha

= 0.85) and good predictive validity with full PTSD assessments (Germain, Hall, Krakow, Shear, & Buysse, 2005).

Resilience.: The Connor-Davidson Resilience Scale (CD-RISC) is a 25-item self-report questionnaire that assesses the degree to which the respondent agrees with a variety of statements about stress and pressure over the past month. Responses are on a 5-point Likert scale, ranging from 1 (*not true at all*) to 5 (*nearly true all of the time*). The CD-RISC has been used frequently with Veteran populations (Green, Calhoun, Dennis, Mid-Atlantic Mental Illness Research Education and Clinical Center Workgroup, & Beckham, 2010; Pietrzak et al., 2009, 2011). Validation of the CD-RISC with a different sample of participants from this same data registry utilized advanced confirmatory factor analysis (CFA) to identify a two-factor solution (i.e., self-efficacy and adaptability) as the best fit for the data (Green et al., 2014). The adaptability factor of the CD-RISC is composed of 8 items including “Able to adapt to change,” “Tend to bounce back after illness or hardship,” and “Coping with stress strengthens.” The self-efficacy factor is composed of six items including “Best effort no matter what,” “You can achieve your goals,” and “When things look hopeless, I don’t give up.” The abbreviated 14-item scale generates a total score ranging from 0 to 56 where higher scores indicate higher levels of resilience. Internal consistency for the 14-item scale for this sample was 0.93, and 0.87 and 0.88 for the self-efficacy and adaptability subscales, respectively.

Psychological distress.: The goal of this study was to better understand Veterans who may be at greater risk for developing an incident mental health disorder. To do this, we examined factors related to elevated psychological distress in the absence of a current mental health disorder. Global psychological distress was assessed using the Global Severity Index (GSI) of the Symptom Checklist-90-Revised (SCL; Derogatis & Spitz, 1999). The SCL is a 90-item self-report measure that assesses how much a problem has distressed or bothered the respondent during the past 7 days. Responses are recorded on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely distressed*). The GSI is a derived score, calculated by summing the response to all items and dividing by the number of items answered. Total GSI scores range from 0 to 4 where higher scores indicate greater overall distress. The SCL has been used with Veteran samples to link higher psychological distress with PTSD (Holmes, Tanielian, & Cox, 1998) and to demonstrate improvements in distress following treatment for PTSD (Perconte & Griger, 1991). For the purposes of this study, the three SCL sleep items were removed when calculating the total GSI score (Items 44, 64, and 66). Cronbach’s alpha in this sample was 0.98.

Covariates

All participants reported demographics including age, race, marital status, total years of education completed, current working status, and number of military tours served. Overall health status was computed based on the number of chronic physical health conditions listed on the National Vietnam Readjustment Study’s Self-Reported Medical Questionnaire (Kulka et al., 1990). The total numbers of lifetime and past-year conditions were tabulated for each respondent. The questionnaire included a total of 37 chronic conditions. Common conditions included asthma, arthritis, diabetes, high blood pressure, cancer, and digestive disorders.

The Combat Exposure Scale (Keane et al., 1989) is a seven-item self-report questionnaire widely used in VA settings which asks participants to report the frequency, duration, and degree of loss for different combat-related experiences. Items ask about serving on dangerous duty, coming under enemy fire, firing at the enemy, witnessing injury or death of a fellow service member, or coming into danger of being injured or killed. Total scores are computed using weighted item scores, and range from 0 to 41. Total scores fall into one of the following categories: light to light-moderate combat (0–16), moderate combat (17–24), or moderate-heavy to heavy combat (25–41). Cronbach's alpha in this sample was 0.85.

The Traumatic Life Events Questionnaire (Kubany et al., 2000), a 24-item self-report scale, assessed number of traumatic life events experienced before, during, and after military service. General categories of traumatic events included accidents, illness, attacks, and sexual assault. The Traumatic Life Events Questionnaire has been used frequently with Veteran populations. Cronbach's alpha in this sample was 0.70.

The 21-item Beck Depression Inventory (Beck, Steer, & Brown, 1996) assesses severity of depressive symptoms over the past 14 days and has demonstrated strong reliability in psychiatric and nonpsychiatric populations (Beck, Steer, & Garbin, 1988). Scores range from 0 to 63 where higher scores indicate greater depressive symptoms. Scores are also translated into severity as follows: no to minimal depression (scores less than 13); mild-to-moderate depression (14 to 19); moderate-to-severe depression (20 to 28); and severe depression (29 to 63). Cronbach's alpha in this sample was 0.90.

Analyses

All analyses were performed using SPSS V21 (IBM, 2012). Research Aim 1 was examined by calculating descriptive statistics for all demographic, health, and sleep variables. Chi-square tests and student *t*-tests were used to compare categorical and continuous variables, respectively, between good and poor sleepers (Buysse et al., 1989). Sequential, hierarchical linear regression was used to examine the degree to which poor sleep contributes to psychological distress controlling for demographic, health, and military-related variables (Research Aim 2a). Variables were entered in the following order: Block 1: demographic variables including age, gender, and physical health status; Block 2: military service (combat exposure); Block 3: sleep (PSQI total score).

Finally, to test whether resilience moderated the relationship between poor sleep and psychological distress (Research Aim 2b), the regression model described above was expanded to include two additional blocks. In Block 4, resilience factors, adaptability and self-efficacy, were entered individually to test whether such factors were inversely associated with psychological distress. In Block 5, three interaction terms were added for purpose of conducting moderation analyses. These three terms were created based on PSQI total score and resilience factors as follows: (a) Sleep $\times$ Adaptability; (b) Sleep $\times$ Self-Efficacy; and (c) Sleep $\times$ Adaptability $\times$ Self-Efficacy. Results were examined for significant interaction terms and the change in variance, as indicated by *R*-squared. The simple slopes of adaptability and self-efficacy were graphed individually to examine the magnitude of the interaction effects. Regression assumptions were also tested by examining plots of the residuals.

Results

This study examined health, demographic, sleep, and resilience characteristics in 1,118 OEF/OIF Veterans who did not meet criteria for a current mental health disorder. The average age of the sample was 38.0 years ($SD = 10.4$; range = 19 to 69), more than three-quarters of participants were male (80.1%, $n = 894$), and approximately one-half were White ($n = 565$, 52%). According to standard clinical criteria (Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008), sleep problems were prevalent across this sample: one-quarter had clinically significant extended sleep onset latency (i.e., 30 min or more; $N = 289$, 25.8%), one-third were clinically short sleepers (i.e., 6 hours or less; $n = 406$, 36.3%), and just under one-half demonstrated clinically significant poor sleep efficiency (i.e., 85% or less; defined as total time asleep out of total time in bed; $n = 550$, 49.2%). More than one-half of all respondents met criteria for poor overall sleep quality (i.e., $PSQI > 5$; $n = 654$, 58.5%; average $PSQI$ score = 7.17, $SD = 3.99$).

Demographic variables associated with poor sleep included non-White race and not currently working. Veterans with clinically significant poor sleep ($PSQI$ total score > 5) endorsed a higher number of lifetime traumatic events and reported worse physical and psychological health. As expected, there were significant quantitative differences in sleep duration, sleep onset latency, and sleep efficiency between individuals who did and did not meet criteria for poor sleep (all $ps < 0.001$). Demographic and sleep characteristics for the sample are shown in Tables 1 and 2, respectively. As hypothesized, worse sleep was associated with higher psychological distress, predicting an additional 16% of the variance over and above health and demographic characteristics. Results are shown in Table 3.

Resilience, defined as stress-coping ability, did significantly moderate the relationship between poor sleep and psychological distress. When examined individually, higher resilience, including self-efficacy and adaptability factors, was associated with less psychological distress in the presence of worse sleep. There was no significant three-way interaction effect between poor sleep, adaptability, and self-efficacy vis-à-vis psychological distress. Results for all interaction effects are shown in Table 3. Graphical results of adaptability and self-efficacy are shown in Figures 2 and 3, respectively. There were no violations of regression assumptions.

Discussion

To our knowledge, this is the first study to examine the relationship between poor sleep, resilience, and psychological distress in a population of post-9/11 military Veterans without a current mental health disorder. This study extended the work of Ulmer et al. (2015) in identifying both risk and protective factors associated with psychological distress among poor-sleeping Veterans without a current mental health disorder. Identification of these factors may help to inform future assessment and preventive practices.

Factors associated with poor sleep included non-White race, worse physical health, prior mental health disorders, more current depressive symptoms, and more lifetime traumatic events. This study demonstrated that worse sleep contributes to greater psychological

distress independently of health and demographic characteristics in Veterans free from a current mental health disorder. This finding is significant in light of research demonstrating that poor sleep predicts subsequent mental health disorders (Ford & Kamerow, 1989; Wright et al., 2011). Longitudinal research examining the presence of risk and protective factors, and the rate at which psychological distress surpasses clinical thresholds to be recognized as a diagnosable mental health condition is warranted.

This study highlighted psychological resilience, defined as positive stress-coping ability, as a potential protective factor for buffering against the effects of poor sleep on psychological distress. Other military-focused researchers have found that poor sleep contributes to less resilient outcomes, in the form of reduced operational readiness and poor health metrics (Seelig et al., 2016; Troxel et al., 2015). However, within the context of poor sleep, this study is the first to define resilience as a psychological construct and examine its role as a predictor rather than an outcome. Results indicated that higher levels of adaptability were inversely associated with psychological distress, suggesting that individuals with higher adaptability were protected against greater psychological distress in the presence of worse sleep. We believe adaptability is important in managing sleep problems. As described earlier, adaptability may be key to adjusting to initial post-deployment or reintegration stressors and the disturbed sleep resulting from such stressors. A similar pattern was found for self-efficacy. Although the self-efficacy items of the CD-RISC do not assess health-related behaviors, we believe traits related to personal competence and tenacity assessed by the scale are relevant to health-related self-efficacy, particularly as this construct relates to maintaining a healthy sleep routine in the presence of one or more stressors. Low resilience may leave Veterans vulnerable to the negative effects of stress, thereby exacerbating sleep problems and increasing risk of resulting psychological distress.

This study establishes a foundation for future studies that elucidate the relationship between sleep, resilience, and psychological distress over time. Longitudinal studies with repeated-measures, including daily sleep diaries and wrist actigraphy, are needed to understand the temporal and directional relationships between sleep, resilience, and psychological health, as well as the stability and variability in these patterns over time. Future studies should supplement findings from psychological constructs identified by the Connor-Davidson Resilience Scale with measures of physiological resilience. Given that resilience is now recognized as a multidimensional construct (Almedom & Glandon, 2007; Southwick, Bonnano, Masten, Panter-Brick, & Yehuda, 2014) and that sleep problems are psychological and physiological in nature, a more comprehensive assessment of resilience is warranted. In addition, most literature on adult resilience has focused on recovery from a single stressful event; less research has focused on stress associated with, or recovery from, repeated daily hassles or chronic, prolonged stress. Veterans who return from deployment with physical or psychological service-related injuries are likely to face repeated stressors and experience chronic stress due to reintegration-related challenges (i.e., family conflict, obtaining employment and financial security, managing physical injuries). Given the cumulative effects of daily stressors are often more detrimental to overall health than a single stressor (Charles, Piazza, Mogle, Sliwinski, & Almeida, 2013; DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982), it will be important that future research examines changes in both sleep and resilience over time.

Despite the strengths of this study, several limitations must be noted. First, this study captured overall sleep quality and did not measure insomnia specifically, nor did it utilize an objective measure of sleep such as wrist actigraphy or polysomnography. Although insomnia-like sleep disturbances can be identified with the PSQI, poor sleep quality may be due to a variety of causes, including sleep apnea and restless leg syndrome. Second, cross-sectional data limits our ability to identify the causes and duration of poor sleep. We were also unable to determine the temporality and directionality between lifetime mental health conditions, military events (e.g., deployment, combat exposure, retirement), poor sleep and psychological distress. Without a full medical or psychiatric history, it is unknown whether poor sleep was a residual symptom of prior mental health conditions or a more recent complaint. Notably, less than 10% of our sample endorsed current, severe depressive symptoms, suggesting prior conditions were not of present concern. Third, although the PSQI and CD-RISC have been frequently used with Veteran populations, each has its limitations. The PSQI, though reliable, has yet to be validated in a Veteran population; thus, it is unclear whether the traditional cut point (total PSQI scores of 5 or greater indicate poor sleep) is clinically appropriate. A lack of validated clinical cut points on the CD-RISC make it difficult to accurately characterize individuals as high or low in resilience. Finally, data collection for the larger research registry described in this article began prior to the release of the *DSM-V*. Revisions to the *DSM-V*, including the elimination of multi-axial diagnoses and adjustments to PTSD criteria, could impact our participant sample, including the number of individuals initially excluded from our sample due to a current PTSD or other mental health disorder.

In closing, this study highlights that poor sleep is associated with elevated psychological distress in Veterans without an active mental health disorder. Additional research is needed to determine whether, and at what rate, psychological resilience may prevent psychological distress and lower risk of incident mental health diagnoses. The prevalence of sleep problems among service members and Veterans will likely remain high or even increase in coming years (Campbell, Shattuck, Germain, & Mysliwiec, 2015). Further, it is unknown how many individuals who initially returned home free of sleep complaints will develop subsequent sleep problems given the ongoing stress associated with reintegration. It is critical VHA and community providers alike continue to address sleep problems in the coming decades and develop an understanding of the long-term effects of poor sleep on Veterans' overall health. A better understanding of the relationship between sleep and resilience may be critical in preventing new mental health problems among Veterans of the Iraq and Afghanistan conflicts and ensuring ongoing health and successful aging for this growing cohort of military Veterans.

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Figure 1.
Relationship between poor sleep, resilience factors, and psychological distress.

Figure 2.
Interactive effects of adaptability and sleep quality on global psychological distress.

Figure 3.
Interactive effects of self-efficacy and sleep quality on global psychological distress.

Table 1.

Demographic, military, and health characteristics of good and poor sleeping Veterans without a current mental health disorder.

Demographics and military characteristics	Total Sample N = 1118	Good Sleeping Veterans PSQI 5 N = 464	Poor Sleeping Veterans PSQI > 5 N = 654	tX^2 (p) [†]
Age, <i>M</i> (<i>SD</i>)	38.0 (10)	37.6 (10.9)	38.2 (10.1)	-0.9 (0.371)
Gender, <i>N</i> (%) Male	913 (82)	392 (84.5)	521 (79.7)	4.2 (0.04)
Race, <i>N</i> (%) ^a				
White, non-Hispanic	565 (51)	271 (58)	305 (47)	17.4 (< 0.001)
Black or African-American	495 (44)	174 (38)	321 (49)	
Other	47 (4)	19 (19)	28 (4)	
Education, total years, <i>M</i> (<i>SD</i>)	13.7 (3.8)	13.9 (4.0)	13.6 (3.6)	1.3 (0.211)
Marital status, <i>N</i> (%) ^a				
Married/living as married	635 (33)	260 (56)	375 (58)	1.1 (0.744)
Divorced or separated	241 (22)	99 (21)	141 (22)	
Never married	240 (21)	105 (23)	135 (21)	
Working status, <i>N</i> (%) ^a				
Not working	330 (30)	106 (23)	224 (34)	17.5 (< 0.001)
Employed part-time	139 (12)	67 (15)	72 (11)	
Employed full-time	647 (58)	290 (63)	357 (55)	
Number of tours served, <i>M</i> (<i>SD</i>)	1.7 (1.4)	1.7 (1.2)	1.8 (1.5)	-0.7 (0.483)
Combat exposure, total score, <i>M</i> (<i>SD</i>)	9.4 (9.2)	9.9 (9.4)	13.9 (4.0)	4.1 (0.100)
Light to light moderate, <i>N</i> (%)	859 (77)	367 (79)	493 (75)	
Moderate	169 (15)	69 (15)	169 (15)	
Moderate heavy to heavy	89 (8)	29 (6)	89 (8)	
Physical and psychological health characteristics				
Number of chronic health conditions, <i>M</i> (<i>SD</i>)	2.5 (2.3)	1.9 (2.1)	2.8 (2.1)	6.6 (< 0.001)
Lifetime	1.7 (1.9)	1.3 (1.6)	2.1 (2.0)	7.5 (< 0.001)
Past year				
One or more lifetime mental health diagnoses ^b , <i>N</i> (%)	478 (43)	148 (32)	330 (51)	38.2 (< 0.001)
Beck Depression Inventory, <i>M</i> (<i>SD</i>)	7.7 (8.0)	4.3 (5.3)	10.2 (8.6)	13.1 (< 0.001)
Number of Lifetime Traumatic Events, <i>M</i> (<i>SD</i>)	2.7 (2.7)	0.9 (1.2)	3.3 (3.0)	9.3 (< 0.001)

Demographics and military characteristics	Total Sample N = 1118	Good Sleeping Veterans PSQI	5 N = 464	Poor Sleeping Veterans PSQI > 5 N = 654	t/X ² (p) [†]
Connor-Davidson Resilience Scale, <i>M</i> (<i>SD</i>)	45.4 (8.3)	47.1 (7.0)	44.1 (8.8)	6.2 (< 0.001)	
Total score	20.0 (3.6)	20.6 (3.2)	19.6 (3.9)	6.7 (< 0.001)	
Factor 1: Self-efficacy	25.3 (5.2)	26.5 (4.5)	24.5 (5.5)	4.5 (< 0.001)	
Factor 2: Adaptability					

^aNot all categories total 100% due to rounding errors and/or missing data (race).

^bLifetime mental health diagnoses determined by the Structured Clinical Interview for *DSM-IV* Disorders (SCID).

[†]Student *t*-tests used for comparisons of continuous variables, chi-square tests of association used to compare categorical variables. Significance level set at 0.002 based on Bonferroni-adjusted comparison rate: 0.05/25 = 0.002.

Table 2.

Sleep characteristics of good and poor sleeping Veterans without a current mental health disorder.

Variable	Total sample (N = 1,118)	Good sleeping Veterans, PSQI 5 (n = 464)	Poor sleeping Veterans, PSQI > 5 (n = 654)	$t/X^2 (p)^{\dagger}$
Sleep characteristics, M (SD)				
Sleep onset latency (min)	29.7 (26.9)	15.4 (11.2)	39.8 (30.0)	-16.7 (< 0.001)
Total sleep time (h)	5.9 (1.4)	6.9 (1.0)	5.3 (1.3)	23.3 (< 0.001)
Sleep efficiency ^a (percent)	79.1% (19.7%)	90.0% (11.0%)	71.4% (20.8%)	17.6 (< 0.001)
Sleep complaints ^b , N(%)				
Trouble falling asleep	322 (30)	25 (5)	297 (45)	212.0 (< 0.001)
Waking up too early	126 (11)	34 (7)	92 (14)	12.3 (< 0.001)
Sleep that is restless or disturbed	261 (23)	26 (6)	215 (33)	80.0 (< 0.001)
Poor sleep quality rating	654 (59)	8 (2)	353 (54)	338.9 (< 0.001)
Nightmares and bad dreams ^b , N(%)				
Frequent trauma-related memories/ nightmares	35 (3)	3 (1)	32 (5)	16.1 (< 0.001)
Frequent nontrauma related memories/nightmares	17 (2)	3 (1)	14 (2)	4.1 (0.044)

[†] Student *t*-tests used for comparisons of continuous variables, Chi-square tests of association used to compare categorical variables. Significance level set at 0.002 based on Bonferroni-adjusted comparison rate: $0.05/25 = 0.002$.

^a Sleep efficiency = total time asleep/total time in bed.

^b Per PSQI-A. Endorsed if reported 3 or more nights per week.

Hierarchical regression of psychological distress on health, demographic, and sleep characteristics and the interaction between poor sleep and resilience factors ($N = 1117$).

Table 3.

Block	Predictor variable	B	SE (B)	β	Adj R^2	R^2	F	p
Block 1								
	Age	-0.008	0.001	-0.180*	0.125	0.128	40.5	<0.001
	Gender	-0.067	0.034	-0.056				
	Race (reference: White)	-0.012	0.026	-0.014*				
	Health status	0.092	0.007	0.372				
Block 2								
	Age	-0.006	0.001	-0.146*	0.152	0.028	40.9	<0.001
	Gender	-0.030	0.034	-0.026				
	Race (reference: White)	-0.042	0.026	-0.045				
	Health status	0.090	0.007	0.363*				
	Combat exposure	0.009	0.001	0.177*				
Block 3								
	Age	-0.006	0.001	-0.131*	0.312	0.159	84.7	<0.001
	Gender	-0.044	0.031	-0.037				
	Race (reference: White)	-0.003	0.024	-0.003				
	Health status	0.061	0.007	0.007*				
	Combat exposure	0.006	0.001	0.001*				
	PSQI total score	0.048	0.003	0.003*				
Block 4								
	Age	-0.004	0.001	-0.101*	0.431	0.120	106.0	<0.001
	Gender	-0.029	0.028	-0.024				
	Race	0.003	0.022	0.004				
	Health status	0.056	0.006	0.227*				
	Combat exposure	0.007	0.001	0.134*				
	PSQI total score	0.039	0.003	0.334*				

Block	Predictor variable	B	SE (B)	β	Adj R^2	R^2	F	p
Block 5	Resilience: Adaptability	-0.023	0.003	-0.225*				
	Resilience: Self-efficacy	-0.016	0.004	-0.126*				
					0.452	0.023	84.3	< 0.001
	Age	-0.005	0.001	-0.104*				
	Gender	-0.026	0.028	-0.0224				
	Race	0.002	0.022	0.002				
	Health status	0.055	0.006	0.221*				
	Combat exposure	0.006	0.001	0.127*				
	PSQI total score	0.147	0.014	1.272*				
	Resilience: Adaptability	-0.005	0.006	-0.055				
	Resilience: Self-Efficacy	-0.003	0.009	-0.026				
	Sleep $\times$ Adaptability	-0.003	0.001	-0.718**				
	Sleep $\times$ Self-Efficacy	-0.004	0.001	-0.505**				
	Sleep $\times$ Adaptability $\times$ Self-Efficacy	0.00006	0.000	0.306				

**
p < 0.05,

*
p < 0.001