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14. ABSTRACT

Introduction: Over one million U.S. military personnel have been deployed since 2001 in support of overseas operations in Iraq and Afghanistan. The deployment environment is filled with uncertainty and a heightened sense of awareness for survival that may impact sleep quality. Research in deployed military personnel has focused on the prevalence of psychiatric problems, but few data are available on the extent of disturbed sleep that may place soldiers at risk both for psychiatric and physical morbidity. The frequency of sleep disturbances (SD) and associated factors in U. S. soldiers were assessed at two different time points after return from deployment.

Method: A convenience sample of U.S. soldiers (n=278, ages 18–60 years) completed the Pittsburgh Sleep Quality Index (PSQI), Post Deployment Health Assessment, perceived stress scale (PSS), and combat exposure scale immediately upon return from deployment (PD1) and 1.5 months later (PD2). **Results:** Approximately 76% of participants had a mean score of >5 on PSQI at both time points, indicating a high prevalence of SD in soldiers after deployment. In PD1, the total variance explained by the hierarchical multiple regression was 41.1%, $F(18, 202)=7.84$, $p<.001$ with PSS ($\beta=.28$, $p<.001$), symptoms of physical illness (PI) ($\beta=.24$, $p=.001$), personal history ($\beta=.23$, $p<.001$), and rank ($\beta=.14-.18$, $ps<.05$) contributing significantly in the final model. In PD2, the total variance was 48.4%, $F(18, 119)=8.14$, $p<.001$ with PSTD ($\beta= 30$, $p<.01$), rank ($\beta=.21-.22$, $ps<.05$), and personal history of SD ($\beta=.20$, $p<.01$) contributing significantly in the final model. **Conclusion:** Deployed soldiers have a high prevalence of SD. Significant predictors at both time points include rank and a personal history of SD. PSS, symptoms of PI, and PTSD can also contribute to persistent SD after deployment; thus, continual follow-up is warranted. Timely identification, assessment, and treatment of SD may ultimately improve health outcomes in this population.

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sleep, mental health, military personnel

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IV. Introduction

Over one million military personnel have deployed since 2001 in support of Overseas Contingency Operations ("Serve, support, and simplify: Report of the President's commission on care for America's returning wounded warrior," 2007). The current deployments have involved a significant number of soldiers engaged in ground combat and hazardous security duty. Deployment includes the following: real and potential exposures to improvised explosive devices (IEDs); gun shots; handling dead bodies, including personal friends and acquaintances; being ambushed; or killing the enemy (Hoge et al., 2004). The deployed environment is clearly a hazardous one, filled with enormous uncertainty and a heightened sense of awareness for survival. Consequently, a high potential for the development of sleep disturbances in soldiers involved in deployment environment exists due to a heightened sense of arousal and anxiety related to deployed environment. However, problems with sleep disturbances are inadequately assessed by healthcare providers in soldiers post-deployment.

Sleep disturbances are often comorbid with psychiatric or medical problems in the civilian population (Breslau, Roth, Rosenthal, & Andreski, 1996; Ohayon, Caulet, & Lemoine, 1998). Sleep disturbances can be both a symptom and a consequence of certain psychiatric problems such as post-traumatic stress disorder (PTSD), anxiety and depression (Breslau et al., 1996; Kaneita et al., 2007; Ohayon et al., 1998). Further, researchers studying sleep disturbances and psychiatric problems have shown that certain sociodemographic and health-related factors such as medical disorders, health status, and symptoms of physical illness increase the risk for both sleep disturbances and psychiatric problems in the general public (Fiedler et al., 2006; Ohayon & Hong, 2002; Walsh, 2004). In addition, a bi-directional relationship exists among sleep disturbances, psychiatric problems, and the report of physical symptoms of medical disorders (Engel, Liu, McCarthy, Miller, & Ursano, 2000; Kendall-Tackett, 2007; Kroenke, Jackson, & Chamberlin, 1997; Ohayon, 2005; Palesh et al., 2007). Previous studies of deployed military personnel have focused on the prevalence of psychiatric problems, particularly those related to PTSD, anxiety, and depression (Hoge, Auchterlonie, & Milliken, 2006; Hoge et al., 2004; Hoge, Terhakopian, Castro, Messer, & Engel, 2007; Prigerson, Maciejewski, & Rosenheck, 2001; Vasterling et al., 2006). However, under-reporting of psychiatric problems may exist due to stigmatization and barriers associated with seeking help for psychiatric problems (Greene-Shortridge, Britt, & Castro, 2007; Hoge et al., 2004). Unfortunately, very little data are available on the extent of sleep disturbances and the associated factors that increase the risk for sleep disturbances in soldiers after deployment.

Even though sleep disturbances are common and treatments are available for most types, problems with sleep are often overlooked and not assessed by healthcare providers during post-deployment assessments. The immediate Post Deployment Health Assessment (PDHA; Department of Defense, DD Form 2796) and the Post Deployment Health Reassessment (90−120 days after initial assessment; PDHRA, DD Form 2900) surveys, completed by all soldiers, contain only two questions related to sleep: 'nightmares', as a screening question for PTSD, and 'problems sleeping', associated with symptoms of physical illness. Hence, using valid and reliable tools, a study assessing the prevalence of sleep disturbances in soldiers returning from deployment could enhance the timely and accurate identification of soldiers with sleep disturbances and those at risk for persistent sleep disturbances. A description of sleep disturbance prevalence is an initial step toward improving the assessment and treatment of disturbed sleep, and it may ultimately improve health outcomes in this population.

V. Scope of the Study

a. Specific aims of study

The purpose of the study was to assess the prevalence of, and identify factors associated with, sleep disturbances in U.S. Soldiers after returning from at least 5-month deployment in support of OEF or OIF

at two different time points: initially upon returning from deployment (post-deployment 1 [PD 1]) and 1 1/2 months after initial data collection (post-deployment 2 [PD 2]). Specific aims of the study were:

Aim 1: Describe and compare the prevalence of sleep disturbances (a global score on the Pittsburgh Sleep Quality Index [PSQI]) and symptoms of sleep disturbance (subscales of the PSQI) in Soldiers initially upon returning from deployment (PD 1) and 1 1/2 months after initial data collection (PD 2).

Aim 2: Describe factors that may be associated with sleep disturbances (global PSQI score) in Soldiers and explore associations among sleep disturbance and sociodemographic factors (e.g., age, gender, race, rank, marital status, and service component), sleep history, psychological factors (PTSD, depression, alcohol use, and perception of stress), symptoms of physical illness/traumatic brain injury (TBI) (DD Form 2796), and environmental risk (combat exposure).

VI. Research Plan

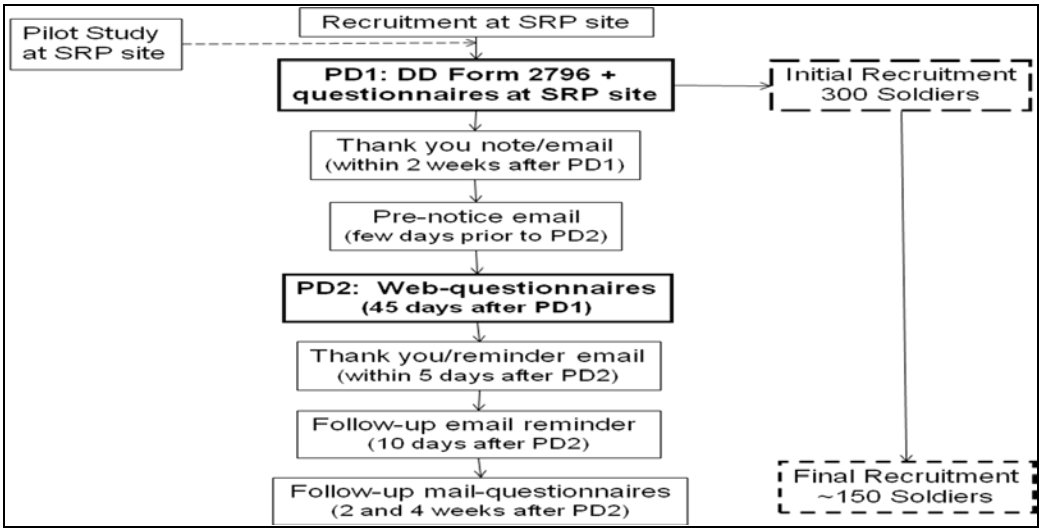
a. Detail of the study

At PD 1, subjects were recruited during their mandatory post-deployment session for all soldiers within two weeks upon returning to stateside at one of the largest military facility in the greater Northwest. A routine 15-minute briefing on administrative and medical processing is conducted for a unit or a group (multiple briefings were given if the unit has a large number of soldiers) by a post-deployment briefer in a designated location for all returning deployed individuals. At the end of the medical briefing by site personnel, the primary investigator was allotted five minutes to speak to soldiers. During this time, a general overview, a detailed purpose of the sleep survey study, consent/HIPAA form, and sleep survey were described to all soldiers. At the end of the study briefing, the soldiers were given the opportunity to volunteer for the study. Consenting to participate in the study included: completing the initial sleep survey; agreeing to release a copy of their DD Form 2796; and providing a mailing and email address (also a part of DD Form 2796 information). The primary investigator screened, briefed, consented, and administered the self-report questionnaires to ensure consistency. Throughout the consent process and the study, the primary investigator stressed that participation was voluntary and confidential. The soldiers had the option of returning the study packet regardless of whether they chose to voluntarily participate in the study or not. Soldiers who consented, returned completed sleep questionnaires, and met the inclusion criteria were entered into the sleep study; this constituted PD 1. Refreshments were provided to all soldiers during this time.

In PD 2, a web-based (WebQ Catalyst) or mailed questionnaire was sent 1 1/2 months after the initial assessment to soldiers who completed the questionnaire in PD 1. Soldiers have an established and mandatory email address via a military mail account. The 1 1/2 month interval was chosen to optimize response rate based on the timing of soldiers integrating back into their units after returning from leave and the stabilization period prior to change in duty stations. WebQ Catalyst, a free online questionnaire or survey software available through the UW learning technology center, was utilized for its potential to reduce cost and increase the response rate (Dillman, 2007). In addition, advantages of WebQ Catalyst included: reminder messages to the participants, immediate checks for incomplete or missing answers, automatic data collection and compilation, and ease of import to SPSS or Excel.

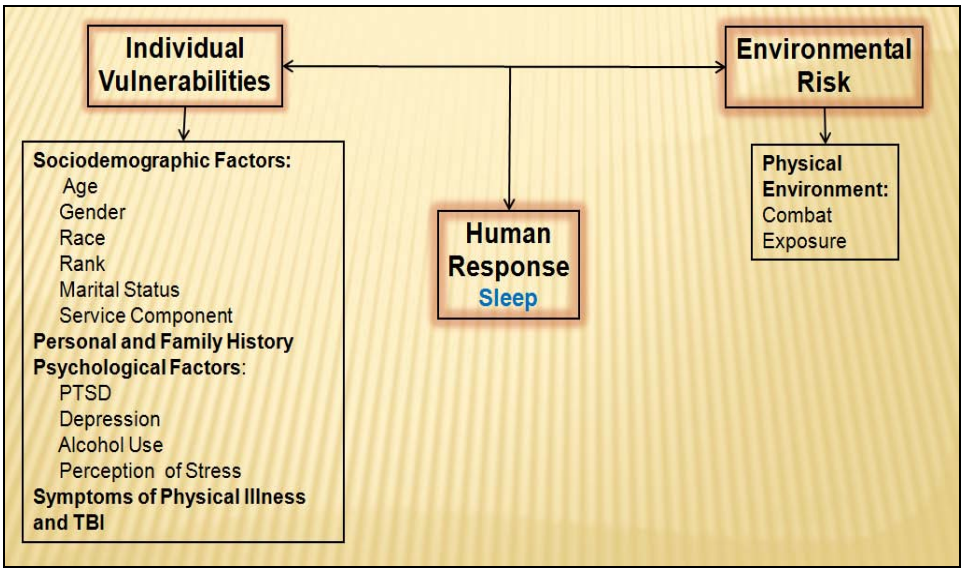
A self-report questionnaire with a stamped envelope addressed to the investigator for ease of return was utilized for nonresponders to the web questionnaire. The questionnaire for PD 2 was similar to PD 1 with identical items on both the web and the mailed questionnaire. The format was similar as much as possible (Dillman, 2007). In addition, a pen was given to soldiers during PD 1 and included in the envelope mailed out for the PD 2 questionnaire. In two randomized controlled trials assessing response rate to first-time nonresponders, the study found that inclusion of pen or pencil statistically increased the return rate 15−19% (White, Carney, & Kolar, 2005).

To increase response rates to both types of questionnaires for PD 2, the recommendation by Dillman (2007) for programmed timing of steps was used (see Figure 4). Steps after the initial questionnaire completion at the SRP site (PD 1) were: (a) a thank you email to those who have completed the questionnaire at SRP site, (b) an email sent out a few days prior to the questionnaire, (c) an email of web-questionnaire with a cover letter, and (d) a follow up email with web questionnaire to nonresponders (up to two times for total of three emails), (e) mailing of questionnaires with a cover letter to nonresponders to web-questionnaires, and (f) final mailing of questionnaires to nonresponders to web-questionnaires.



b. Framework

A biobehavioral human health response model was chosen for the study. The overarching concepts in the model assume dynamic interactions between individual vulnerability and risks in the environment (see Figure 1). This dynamic interaction influences individual responses that further influence outcomes (Heitkemper & Shaver, 1989; Shaver, 1985). Individual vulnerability is defined as characteristics of individual or personal factors (e.g., age, gender, etc); whereas risk is attributed to the social or physical environment − the context that influences individual responses. This framework was used in the proposed study to investigate the dynamic interaction of individual vulnerabilities of sociodemographic and psychological factors with the environmental risk of combat exposure to assess the health response of sleep in military personnel.



c. Design

Descriptive study utilizing surveys at two different time points: upon returning from deployment (PD1) and 1 1/2 months after initial data collection (PD2).

d. Sampling Plan: Inclusion, Exclusion Criteria

Inclusion criteria were soldiers who voluntarily joined the United States military and deployed in support of Overseas Contingency Operations (specifically Afghanistan or Iraq) for at least five months, were between the ages of 18−65 years, and were processing through the post-deployment session site in the greater Northwest. Participants were able to read and understand English for consent purposes only. All ranks (enlisted and officer personnel) and service components (Active duty [AD], National Guard [NG], and Reserve Component [RC]) were included to capture experiences of all military personnel. Soldiers who received serious injury and/or hospitalization during deployment were excluded. By processing through the post-deployment session site, soldiers were considered to be healthy and not to have received serious injury and/or hospitalization during deployment. This was assumed because those who are seriously injured and/or hospitalized are often evacuated back to United States and are treated in the military medical or Veteran Affairs facilities.

e. Recruitment/Tracking: see Table 1

f. Description of Intervention, if applicable: N/A

g. Data Collection/Measurements

Overview
Most published studies on military personnel have used existing data from the Department of Defense (DD) database on military men and women ages 18+, in all ranks and services (e.g., Marines, Navy, Air Force, or Army). One such source of data is from the PDHA, DD Form 2796 which all soldiers are required to complete after returning from deployment outside of the United States (see Appendix A). The primary focus of the DD Form 2796 is to identify psychological and medical problems and provide

medical care by using comprehensive screening questions (DHCC, 2007). The DD Form 2796 is a multidimensional tool consisting of sociodemographic information (e.g., gender, branch of service, component, rank), environmental and combat exposures (e.g., exposure to chemicals and witnessing anyone being wounded, killed, or dead), and questions regarding psychiatric problems and physical symptoms.

In designing this study, a major concern was the burden placed on the participant in completing additional surveys during the post-deployment session. Often times, returning soldiers are asked to complete multiple self-report questionnaires during the potentially lengthy post-deployment process. To alleviate such burden, the majority of sociodemographic factors (age, gender, rank, service component), psychological factors (PTSD, depression, alcohol use), and symptoms of physical illness/TBI were gathered from DD Form 2796. Two additional sociodemographic factors (race and marital status), family history, and the self-report questionnaires on sleep disturbances, perception of stress, and combat exposure were gathered separately. The self-report questionnaire took 5 to10 minutes to complete. (Table 1).

Table 1. Measures

VARIABLES	MEASURES	ITEMS
Sleep Disturbances	Pittsburgh Sleep Quality Index	18
Sociodemographic Factors:		
Age Gender Race Rank Marital Status Service Component	DD Form 2796 + additional information on race and marital status	6
Personal and Family History	Additional information	7
Psychological Factors:		
PTSD	DD Form 2796 (PC-PTSD)	4
Depression	DD Form 2796 (PHQ-2)	2
Alcohol Problem	DD Form 2796 (TICS-2)	2
Perception of Stress	Cohen's Perceived Stress Scale (PSS)	10
Symptoms of Physical Illness/TBI	DD Form 2796	25
Combat Exposure	Combat Exposure Scale	7

Sleep Disturbance

The Pittsburgh Sleep Questionnaire Index (PSQI), a 19-item self-report questionnaire of sleep disturbance over the past month, is a widely used measure for assessment of sleep disturbance in healthy and psychiatric populations (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002; Buysse et al., 1989). Nineteen items are used to measure multiple components of sleep disturbances: subjective quality (1 item), sleep latency (2 items), sleep duration (1 item), habitual sleep efficiency (3 items), sleep disturbances (9 items), medication usage (1 item), and daytime dysfunction (2 items). Items 1 through 4 are free entry related to bed time. Question 4, "How many hours of actual sleep did you get at night," is used for both sleep duration and habitual sleep efficiency component. Items 5 through 18 are on a 4-point Likert scale with 0 for "not during the past month"; 1 for "less than once a week"; 2 for "once or twice a week"; and 3 for "three or more times a week." Item 19 is also a 4-point Likert scale on the overall sleep quality: 0 for "very good"; 1 for "fairly good"; 2 for "fairly bad"; and 3 for "very bad." Question 10, "Do you have a bed partner or roommate?", was not counted in the component score. Each component score ranges from 0−3 with the global score from 0−21. A cutoff score of > 5 in the global score indicates a

clinical sleep disturbance in at least two components or moderate difficulties in more than three components.

PSQI has been used clinically to evaluate overall sleep quality and disturbances and to assess effectiveness of pharmacologic or behavioral interventions (Edinger, Wohlgemuth, Radtke, Coffman, & Carney, 2007; Littner et al., 2003). However, it does not assess sleep disturbances related to restless leg movement and periodic limb movement. Psychometric properties of PSQI have been validated in a variety of clinical and research settings. PSQI has established validity and reliability (Cronbach's $\alpha = .83$) with acceptable test-retest value (.65−.84). Cronbach's α was .82 for the current study.

Sociodemographic Factors

Specific sociodemographic factors such as age (years), gender (male and female), rank (E1 thru O6), and service component (AD, NG, and RC) were obtained from DD Form 2796. Race and marital status were obtained on the PD 1 questionnaire.

Personal and Family History

Personal (4 items) and family (3 items) history of sleep disturbances including the types of sleep disturbances, if applicable, were addressed. Four questions related to personal sleep history were: "How well did you sleep on an average night at home BEFORE your deployment?"; "On average, how many hours did you sleep before your deployment?"; "In the past (prior to deployment), have you ever had sleep disturbance? (yes/no)" and "If yes (to the third question), please indicate the type of sleep disturbance." Three questions related to the history of immediate family members were included: "Do any of your immediate family members presently have or ever had sleep disturbance? (yes, no)"; "If yes, who has the sleep disturbance? (e.g., parents, children, brothers, or sisters); and "The type of sleep disturbances (e.g., insomnia, sleep apnea, restless leg syndrome, others, or I do not know)." Endorsement to the first question was counted as a positive family history.

Psychological Factors

PTSD. Primary Care Post Traumatic Stress Disorder Screen, PC-PTSC (Prins et al., 2003), is a 4-item screen used in primary care settings (Ouimette, Wade, Prins, & Schohn, 2008; Seal et al., 2007). These items were derived from the DSM-IV (American Psychiatric Association, 1994) criteria and symptoms related to PTSD (re-experiencing, avoidance, hyperarousal, and numbing). Answers to the four questions are coded "No" = 0 and "Yes" = 1 and summed for a total score ranging from 0−4. The cutoff score for PC-PTSD is ≥ 2 for both general and veteran populations. A validation study conducted by the USAMRU-E (Bliese et al., 2005) on over 900 soldiers returning from combat in Iraq showed a sensitivity of .73−.79 and a specificity of .78−.88 when compared to the "gold standard", the Clinician Administered PTSD Scale (CAPS). In studies of veterans with depression and substance abuse seen by the Veterans Affairs, sensitivity and specificity were .45−.70 and .66−.96, respectively (Gerrity et al., 2007; Kimerling, Trafton, & Nguyen, 2006; Ouimette et al., 2006). For this study, Cronbach's α = .86. Inter-item correlation mean was .62 and ranged from .45 to .71.

Depression. A 2-item scale Patient Health Questionnaire-2 (PHQ-2) was used to assess depressed mood and anhedonia (Corson, Gerrity, & Dobscha, 2004; Kroenke, Spitzer, & Williams, 2001, 2003; Whooley, Avins, Miranda, & Browner, 1997). The main question is: "Over the past month, how have you been bothered by…" with two stem questions: "little interest or pleasure in doing things" and "feeling down, depressed, or hopeless" with scoring of 0 = "not at all" to 3 = "nearly every day". Thus, the total score ranges from 0−6. The cutoff score is set at 3 in the general and veteran populations. Sensitivity and specificity have been reported as .73−.83 and .86−.92, respectively. Cronbach's α was .92 for this study. Inter-item correlation mean was .85. The range equaled the inter-item correlation mean.

Alcohol Use. The 2-item question related to alcohol usage from DD 2796 was utilized. This was adopted from an alcohol and substance abuse screening tool by Brown et al. (2001). The two questions are: "Did you use alcohol more than you meant to?" and "Have you felt you wanted or needed to cut down on your drinking?" The questions are prefaced by "Alcohol is occasionally available during deployments, e.g., R&R, port call, etc. Prior to deploying or during this deployment:" Endorsement on both questions has a sensitivity and specificity of .73 and .86, respectively. For this study, Cronbach's α was .65 with mean inter-item correlation of .48. The range equaled the inter-item correlation.

Perception of Stress. Perceived Stress Scale-10 (PSS-10), was used to measure psychological stress. It is a 10-item Likert-type scale that measures the degree to which situations or events a person identifies as stressful are related to daily hassles, major events, and changes in the availability of coping resources over a 1-month period. Thus, PSS-10 is sensitive to stress from ongoing life and future circumstances and events. Each item had a 5-point Likert-scale ranging from "0" = never to "4" = very often. A PSS-10 score can range from 0−40 with a higher score indicating a higher level of perceived stress. Normative mean score for 18 to 54-age group is 13.3 (*SD* = 6.3). An internal validity study in 2,300 subjects revealed that PSS-10 had a slightly higher internal Cronbach's α of .86. It also had a high internal consistency with Cronbach's α of .90 for this study.

Symptoms of Physical Illness and Traumatic Brain Injury

Question 8 on DD Form 2796 asks about the 24 symptoms (e.g., headaches, fever, back pain, irritability) during deployment that resulted in seeking care from a healthcare provider (sick call) and/or receiving permission to stay at home or limiting the usual amount or level of work (quarters or profile). This question also asks the respondents to indicate whether they are currently bothered by the symptoms that caused them to seek care. Any endorsements in the "still bothered? (yes, no)" column were counted as a symptom of physical illness. Scores range from 1−24, with higher scores indicating a higher number of symptoms of physical illness.

Mild TBI screening question from DD Form 2796 (question 9b) was used: "Did any of the following happened to you, or were you told happened to you, IMMEDIATELY after any of the event(s) you just noted in question 9a? (yes, no) LOC, felt dazed, or don't remember (yes, no)." Endorsement of any of the three answers ("LOC", "felt dazed", or "don't remember") were considered as having a mild TBI. Post-concussion syndrome (e.g., dizziness, headache, difficulty concentrating, impairment of memory, sleep disturbance, and irritability) was assessed using question 9d for PD 1 (TBI score) and six items from the 24-item symptoms of physical illness for PD 2 (symptoms of TBI). These symptoms will be gathered during PD 1 and PD 2.

Combat Exposure

The Combat Exposure Scale (CES) was developed to quantify subjective reports of wartime stressors experienced by combatants and to quantify the construct of combat exposure for use in clinical research (Keane et al., 1989). CES is a 7-item Likert-type scale with 5-response points: 1 is "no", 2 is "1 to 3 times", 3 is "4 to 12 times", 4 is "13 to 50 times", and 5 is "51+ times." Each item is weighted differently based on the severity of the experience (e.g., "Seeing someone hit by incoming enemy rounds" or "Were you ever surrounded by the enemy?" is weighted more than "Firing rounds at the enemy?" or "Were you ever under enemy fire?"). Total scores range from 0−41. A study of Vietnam veterans with PTSD had a mean CES score of 29.37 (*SD* = 6.12) and without PTSD had a mean CES score 22.84 (*SD* = 10.42). Reliability has been reported as α = .85 with strong test-retest value established as .97 (Keane et al., 1989). Cronbach's α was .71 for the current study. The inter-item correlation mean was .30 with the range from .04 to .52.

VII. Data Analysis Table 1. Recruitment and Retention

If this does not apply to your study, check here ☐

	Projected # from original proposal		Actual #	
# subjects available			1940	
# subjects contacted			1921	
# subjects screened			317	
# subjects refused			1604	
# subjects ineligible			39	
# subjects consented				
Time1/Time2	300	150	(Time1) 317	
# subjects enrolled				
Time1/Time2	300	150	278	
# subjects dropped out				
Time1/Time2			120	
# subjects completed				
Time1/Time2	300	150	(Time2) 158	

VIII. Results/Discussion

a. The population in which these psychometric properties were established are presented in Table 1. See also Appendix C.

Participants

Of the 1940 participants that were briefed at the SRP site, a total of 317 (16%) participants completed the questionnaires at PD 1. Thirty-nine of 317 (12%) participants were excluded because they did not meet the criteria of deployment to either Afghanistan or Iraq for five months. A web-based questionnaire (WebQ) was emailed 1 1/2 months after the initial assessment to 278 participants. The total number of participants who completed the PD 2 questionnaire was 158 out of 278, a return rate of 57%. Of these 158 participants, 77 (48%) completed the WebQ and 81 (51%) completed the mailed questionnaire. The final sample for analysis was 278 for PD 1 and 158 for PD 2.

There were no differences between participants who completed the questionnaires (responders, n = 158) at PD 2 and those who did not (nonresponders, n = 116) in gender, race, marital status, or location of deployment (see Table 2). However, responders were significantly older in age ($t(272) = -4.12$, $p = <0.01$), included more officers ($U = 5785.50$, $z = -5.44$, $p = <0.01$), Caucasians ($U = 7113$, $z = -2.60$, $p = <0.01$), and in the NR/RC service component ($U = 7566.5$, $z = -3.25$, $p = <0.01$) than nonresponders.

Table 2 also shows the demographic data of soldiers who completed the questionnaires at PD 1 and PD 2. For PD 1, the majority of the sample was male, enlisted in the ranks of E1 to E9, Caucasian, and married. In addition, the majority of participants was AD and deployed to Iraq. Soldiers who completed PD 1were on average 32 years of age (SD = 8 years; range, 18−60). These soldiers had an average length of deployment of 350 days (SD = 88 days; range, 153−537). For PD 2, participants between service components were almost equivalent and were on the average 34 years of age (SD = 9 years; range, 18−60). These soldiers were deployed on the average of 340 days (SD = 91 days; range, 153−537).

Table 2. Sociodemographic Factors for Participants at PD 1 and PD 2

	PD 1[a] n = 278	PD 2[b] n = 116	PD 2[c] n = 158
Age (yrs), *M* (*SD*)	31.8 (8.4)	29.5 (7.2)	33.6 (8.8)
Gender, n (%)			
Female	77 (28)	27 (23)	46 (29)
Male	201 (72)	89 (77)	112 (71)
Rank, n (%)			
Enlisted	202 (73)	99 (85)	99 (63)
Officers	76 (27)	17 (15)	59 (37)
Race, n (%)			
White/Caucasian	201 (72)	74 (69)	127 (80)
African American/Others	77 (28)	34 (31)	31 (20)
Marital Status, n (%)			
Single	100 (36)	49 (41)	47 (30)
Married	178 (64)	67 (59)	111 (70)
Service Component, n (%)			
AD	205 (74)	98 (85)	107 (68)
NG/RC	73 (26)	18 (15)	51 (32)
Deployment Location, n (%)			
Afghanistan	66 (23)	25 (22)	37 (23)
Iraq	212 (77)	91 (78)	121 (77)

Note: [a] Participants who completed PD 1 [b] Participants who did not complete PD 2 [c] Participants who completed PD 2.
AD = Active Duty, NG/RC = National Guard/Reserve Component.

b. Reliability and validity for all instruments used in this study are presented in Table 3. See also Appendix C.

Table 3. Reliability and Validity of Instruments

VARIABLES	MEASURES	ITEMS	CHRONBACH'S α
Sleep Disturbances	Pittsburgh Sleep Quality Index	18	.727
Sociodemographic Factors:			
Age Gender Race Rank Marital Status Service Component	DD Form 2796 + additional information on race and marital status	6	N/A
Personal and Family History	Additional information	7	N/A
Psychological Factors:			
PTSD	DD Form 2796 (PC-PTSD)	4	.829
Depression	DD Form 2796 (PHQ-2)	2	.860
Alcohol Problem	DD Form 2796 (TICS-2)	2	.560
Perception of Stress	Cohen's Perceived Stress Scale (PSS)	10	.881
Symptoms of Physical Illness/TBI	DD Form 2796	25	N/A
Combat Exposure	Combat Exposure Scale	7	.666

c. Explain how each specific aim or research question/hypothesis was answered by your findings/data. Include your data analysis per item.

Specific Aim 1: PSQI Scores

Table 4 presents the PSQI global score and seven PSQI subscale scores for participants at PD 1 and at PD 2. The mean PSQI global score was high, with 77% and 76%, respectively, of participants reporting sleep disturbances, based on the PSQI cut off score of >5, at both time points. In PD 1, participants indicated problems in sleep quality, sleep latency, sleep duration, sleep disturbances, (e.g., room temperature, coughing, use of the bathroom, etc.) and daytime dysfunction. The average 5.6 hours of sleep in the past month was less than the average 7.1 hours of sleep before deployment. In addition, participants reported sleep quality to be worse than before deployment. In PD 2, participants indicated problems in sleep quality, sleep latency, sleep duration, sleep disturbances, and daytime dysfunction. The hours of sleep and sleep quality continued to be worse than before deployment.

Table 4. Scores of PSQI Global, PSQI Subscales, and Other Sleep Factors of Participants for PD 1 and PD2

	PD 1 n = 278[a]		**PD 2 n = 158**[b]	
	Mdn	***M (SD)***	***Mdn***	***M (SD)***
PSQI Global Score	10.0	9.3 (4.0)	9.0	9.1 (4.3)
Subscales				
Sleep Quality	2.0	1.5 (0.8)	1.0	1.5 (0.8)
Sleep Latency	2.0	1.9 (1.1)	2.0	1.7 (1.1)
Sleep Duration	2.0	1.7 (1.0)	1.0	1.5 (1.0)
Sleep Efficiency	0	0.9 (1.1)	0	0.9 (1.1)
Sleep Disturbances	1.0	1.5 (0.6)	2.0	1.6 (0.7)
Medication Usage	0	0.8 (1.0)	0	0.6 (1.0)
Daytime Dysfunction	1.0	1.1 (0.8)	1.0	1.3 (0.7)
Other Sleep Variables				
PSQI Hours of Sleep	5.5	5.6 (1.5)	6.0	5.7 (1.3)
Hours of Sleep Before Deployment	7.0	7.1 (1.3)	7.0	7.0 (1.1)
Sleep Quality Before Deployment	1.0	0.8 (0.7)	1.0	0.8 (0.7)
PSQI >5, n (%)[c]	195 (77%)		118 (76%)	

Mdn = median, M = mean, SD = standard deviation, PSQI = Pittsburgh Sleep Quality Index.
Note. [a] due to missing data n varies from 247 to 278 according each category, [b] due to missing data n varies from 146 to 158 according to each category, [c] PD 1 n = 252 and PD2 n = 156.

A comparison of PSQI global and subscale scores from PD 1 to PD 2 of 158 participants who responded at both time points are presented in Table 5. Overall, the PSQI global score remained high; subscale score for daytime dysfunction and hours of sleep after deployment increased and were statistically significant difference from PD 1 to PD 2.

Table 5. Differences in Scores of PSQI Global, PSQI Subscales, and a Sleep Variable in 26 Participants from PD 1 to PD 2

	PD 1 n = 158[a]	**PD 2 n = 158**	***p***[b]
	***M* (*SD*)**	***M* (*SD*)**	
PSQI Global Score	9.3 (3.9)	9.1 (4.3)	0.18
Subscales			
Sleep Quality	1.6 (0.7)	1.5 (0.8)	0.47
Sleep Latency	1.8 (1.0)	1.7 (1.1)	0.08
Sleep Duration	1.6 (1.0)	1.5 (1.0)	0.12
Sleep Efficiency	0.9 (1.1)	0.9 (1.1)	0.94
Sleep Disturbances	1.6 (0.6)	1.5 (0.7)	0.22
Medication Usage	0.8 (1.1)	0.6 (1.0)	0.05
Daytime Dysfunction	1.1 (0.8)	1.3 (0.7)	<0.01
Other Sleep Variable			
PSQI Hours of sleep	5.5 (1.3)	5.8 (1.5)	0.03

Note. [a] due to missing data n varies from 142 to 158 according each category. [b]Analysis conducted using the paired t-test for differences.
PSQI = Pittsburgh Sleep Quality Index.

Specific Aim 2: PSQI Scores and Associated Factors

Table 6 presents various associated factors at PD 1 and PD 2. Participants in PD 1 had a high rate or score of personal history of sleep disturbance, PTSD, and PSS. Participants in PD 2 had a high rate of personal history of sleep disturbance, PTSD, depression and a high score of PSS. The majority of participants who had a positive personal history, PTSD, depression, and TBI had PSQI >5.

Table 6. Sleep History, Psychological Factors, Symptoms of TBI/Physical Illness and PSQI ('good' and 'poor') Scores for PD 1 and PD 2

	PD 1 n = 239	PSQI ≤5 Good n = 55	PSQI >5 Poor n = 184	PD 2 n = 146	PSQI ≤5 Good n = 35	PSQI >5 Poor n = 111
Personal History Yes, n (%)	93 (38.9)	6 (6.5)	87 (93.5)	61 (41.8)	3 (4.9)	58 (95.1)
PTSD ≥2, n (%)	31 (12.9)	2 (6.5)	29 (93.5)	53 (36.3)	4 (7.5)	49 (92.5)
PTSD, M (SD)	0.4 (1.0)	0.2 (0.5)	0.5 (1.1)	1.1 (1.4)	0.2 (0.7)	1.4 (1.5)
Depression ≥3, n (%)	18 (7.5)	2 (11.1)	16 (88.9)	24 (16.4)	1 (4.2)	23 (95.8)
Depression, M (SD)	0.9 (1.3)	0.5 (0.9)	1.1 (1.4)	1.6 (1.7)	0.7 (0.8)	1.8 (1.7)
PSS, M (SD)	15.8 (7.1)	10.4 (5.6)	17.4 (6.7)	15.2 (7.2)	11.2 (5.9)	16.5 (7.2)
TBI Yes, n (%)	16 (6.7)	2 (12.5)	13 (81.3)	9 (6.2)	2 (22.2)	7 (77.8)
Symptoms of TBI, M (SD)	0.3 (0.9)	0.1 (0.3)	0.3 (1.0)	1.0 (1.4)	0.4 (0.9)	1.1 (1.5)
Symptoms of PI, M (SD)	2.4 (3.2)	0.7 (1.3)	2.8 (3.5)	2.8 (4.1)	1.3 (1.8)	3.4 (4.4)

PSQI = Pittsburgh Sleep Quality Index, PTSD = Post-Traumatic Stress Disorder, PSS = Perceived Stress Scale, TBI = Traumatic Brain Injury.

Table 7 and 8 presents the demographic and other associated factors with the PSQI global score at PD 1 and PD 2. At PD 1, age, gender, and rank were negatively and statistically significant with PSQI global score. In addition, personal history of sleep disturbance, PTSD score, depression score, PSS, symptoms of physical illness/TBI, and combat exposure score were low to moderately associated and statistically significant with the PSQI global score. Thus, the PSQI global score was higher in participants who were younger, female, lower in rank, had a personal history of sleep disturbance, higher PTSD and depression score, higher perception of stress, more symptoms of physical illness/TBI, and more combat exposure. At PD 2, rank, personal history of sleep disturbance, PTSD score, depression score, alcohol score, PSS, and symptoms of physical illness/TBI were low to moderately associated and statistically significant with the PSQI global score.

Table 7. Correlations of PSQI Global Score and Sociodemographic Factors at PD 1 and PD 2

	PSQI Global	
	PD 1	PD 2
	n = 217	n = 137
Age	-0.14*	-0.14
Gender	-0.19**	-0.16
Rank	-0.25**	-0.44**
Race	0.05	0.10
Marital Status	-0.03	-0.02
Service Component	0.07	-0.02

Note. Analysis conducted using Pearson's correlation.
PSQI = Pittsburgh Sleep Quality Index.
* < 0.05 ** < 0.01

Table 8. Correlations of PSQI Global Score and Other Associated Factors at PD 1 and PD 2

	PSQI Global	
	PD 1	PD 2
	n = 217	n = 137
Personal History	0.35**	0.38**
Family History	0.07	-0.03
PTSD	0.18*	0.53**
Depression	0.28**	0.48**
Alcohol	0.08	0.19*
PSS	0.46**	0.49**
Symptoms of PI	0.44**	0.35**
Symptoms of TBI	0.18**	0.34**
Combat Exposure Scale	0.17*	0.12
Days of Deployment	-0.10	-0.12

Note. Analysis conducted using Pearson's correlation.
PSQI = Pittsburgh Sleep Quality Index, PTSD = Post Traumatic Stress Disorder, PSS = Perceived Stress Scale, PI = Physical Illness, TBI = Traumatic Brain Injury.
* < 0.05 ** < 0.01

A partial correlation was conducted to control for factors that influence sleep. The PSQI global score and associated factors after controlling for age, gender, and rank are presented in Table 9. At PD 1 and PD 2, there was a low to moderate, positive and statistically significant partial correlation between PSQI global score and personal history of sleep disturbances, PTSD score, depression score, PSS, symptoms of physical illness/TBI, and combat exposure scale controlling for age, gender, and rank. At PD 2, in addition to six factors at PD 1, alcohol score was also positively and statistical significant with PSQI global score.

Table 9. Partial Correlations of PSQI Global Score and Associated Factors at PD 1 and PD 2 Adjusted for Age, Gender, and Rank

	PSQI Global	
	PD 1	PD 2
	n = 217	n = 137
Race	-0.01	0.02
Marital Status	0.00	0.02
Service Component	0.05	-0.05
Personal History	0.36**	0.38**
Family History	0.06	-0.02
PTSD	0.21**	0.49**
Depression	0.25**	0.41**
Alcohol	0.10	0.21*
PSS	0.41**	0.40**
Symptoms of PI	0.43**	0.32**
Symptoms of TBI	0.18**	0.32**
Combat Exposure Scale	0.23**	0.20*
Days of Deployment	-0.09	-0.11

Note. Analysis conducted using Pearson's correlation.
PSQI = Pittsburgh Sleep Quality Index, PTSD = Post Traumatic Stress Disorder, PSS = Perceived Stress Scale, PI = Physical Illness, TBI = Traumatic Brain Injury.
* < 0.05 ** < 0.01

Six factors were associated with PSQI global score at both assessment time points even after adjusting for age, gender, and rank. These were personal history of sleep disturbance, PTSD score, depression score, PSS, symptoms of physical illness, and symptoms of TBI. As shown in Table 6, in PD 1, 93 of 239 participants had a personal history of sleep disturbances and of these 87 (94%) of 93 participants had PSQI >5 identifying them as poor sleepers. The most frequent type of sleep disturbances was 'insomnia' (n = 42), followed by 'others' and 'don't know' (n = 21), 'sleep apnea' (n = 15), and 'restless leg syndrome' (n = 10). In PD 2, 61 of 146 participants had a personal history of sleep disturbances and of these 58 (95%) of 61 also had PSQI >5. The most frequent type of sleep disturbance was also 'insomnia' (n = 28), followed by 'others' (n = 14), 'don't know' (n = 13), 'restless leg syndrome' (n = 9), and 'sleep apnea' (n = 5).

Psychological factors such as PTSD, depression, and PSS also showed either a high rate or score. In PD 1 of 239 participants, 31 had positive endorsement of PTSD, 18 had positive endorsement of depression, and a high average score of 15.8 in PSS. Participants who had PSQI >5 had higher rates of PTSD, depression, and a higher score of PSS than those with PSQI <5. In PD 2 of 146 participants, 53 had positive endorsement of PTSD, 24 had positive endorsement of depression, and a high average score of 15.2 in PSS. In PD 2, participants also had higher rate and score than those with PSQI >5.

Table 6 shows that the average number of symptoms of TBI and physical illness at PD 1 and PD 2. At both time points, participants who had PSQI >5 had a higher number of symptoms in TBI and physical illness. The frequency of each symptom of physical illness is shown in Table 10. The most frequently endorsed symptom for TIB and physical illness was 'problems sleeping' at PD 1 and PD 2.

Table 10. Frequency of Symptoms of Physical Illness at PD 1 and PD 2

	PD 1 n = 274 n (%)	PD 2 n = 158 n (%)
Problems Sleeping*	90 (32.8)	43 (27.2)
Increased Irritability*	60 (21.9)	35 (22.2)
Forgetful*	41 (15.0)	31 (19.6)
Trouble Concentrating*	40 (14.6)	31 (19.6)
Hard to Make Up Mind	17 (6.2)	21 (13.3)
Headaches*	32 (11.7)	20 (12.7)
Numbness/Tingling	30 (10.9)	16 (10.1)
Weakness	14 (5.1)	18 (11.4)
Dizzy, Light Headed	9 (3.2)	7 (4.4)
Trouble Hearing	22 (8.0)	19 (12.0)
Ringing in Ears	19 (6.9)	12 (7.6)
Dimming of Vision	5 (1.8)	--
Red Eyes	14 (5.1)	13 (8.2)
Trouble Breathing	16 (5.8)	8 (5.1)
Cough	14 (5.1)	8 (5.1)
Fever	4 (1.5)	2 (1.3)
Chest Pain	11 (4.0)	5 (3.2)
Heartburn	17 (6.2)	15 (9.2)
Diarrhea	13 (4.7)	12 (7.6)
Vomiting	2 (0.7)	1 (0.1)
Joints	67 (24.5)	33 (20.9)
Back Pains	59 (21.5)	37 (23.4)
Muscle Aches	27 (9.9)	27 (17.1)
Skin Diseases or Rash	16 (5.8)	6 (3.8)
Others	30 (10.9)	10 (6.3)

Note. * Symptoms of TBI at PD 2.

Table 11 presents factors that made significant contributions to sleep disturbances after controlling for each category of factors. In PD 1, demographic factors explained 12%; sleep history explained additional 12%, R^2 change = .12, F change (2, 209) = 15.77, p = .001; psychological factors explained another 12%, R^2 change = .12, F change (4, 205) = 9.85, $p < .001$; and symptoms of PI/TBI and combat exposure explained 5%, R^2 change = .05, F change (3, 202) = 5.90, p = .001, of the variance in sleep disturbances. Thus, the total variance explained by the model as a whole was 41.1%, F (18, 202) = 7.84, $p < .001$. In the final model, four measures were statistically significant, with perceived stress (PSS) recording a

higher β value (β = .28, $p < .001$) than symptoms of physical illness (PI) (β = .24, $p = .001$), personal history of sleep disturbances (SD) (β = .23, $p < .001$), or rank, enlisted/specialized personnel, (β = .14−.18, ps < .05).

Table 10. Predictors of Sleep Disturbance in PD 1

	b	SE b	β
Step 1			
Constant	9.05	1.76	
Rank_E1E4	2.25	0.86	.24**
Rank_E5E6	2.47	0.73	.29**
Rank_E7W3	2.37	0.84	.22**
Gender	-1.53	0.60	-.17*
Step 2			
Constant	8.51	1.87	
Rank_E1E4	2.24	0.81	.24**
Rank_E5E6	1.95	0.69	.23**
Rank_E7W3	1.63	0.80	.15*
Gender	-1.47	0.57	-.17*
Personal History	2.90	0.52	.36**
Step 3			
Constant	4.74	1.66	
Rank_E1E4	1.82	0.76	.19*
Rank_E5E6	1.58	0.64	.19*
Rank_E7W3	1.73	0.74	.16*
Race	1.16	0.58	.12*
Personal History	2.24	0.49	.28**
PSS	0.18	0.04	.33**
Step 4			
Constant	5.23	1.63	
Rank_E1E4	1.72	0.74	.18*
Rank_E5E6	1.45	0.62	.17*
Rank_E7W3	1.56	0.72	.14*
Personal History	1.89	0.49	.23**
PSS	0.16	0.04	.28**
Symptoms of PI	0.29	0.08	.24**

Note. Analysis conducted using hierarchical multiple regression.
$R^2 = .12$ for Step 1; $\Delta R^2 = .12$ for Step 2; $\Delta R^2 = .12$ for Step 3; $\Delta R^2 = .05$ for Step 4 (ps < .01).
* < 0.05 ** < 0.01.
PSQI = Pittsburgh Sleep Quality Index, PSS = Perceived Stress Scale, PI = Physical Illness.

Likewise, Table 11 presents factors that made significant contributions to sleep disturbances after controlling for each category of factors. In PD 2, demographic factors explained 26%; sleep history explained additional 11%, R^2 change = .11, F change (2, 126) = 10.31, $p < .001$; psychological factors explained another 17%, R^2 change = .17, F change (4, 122) = 11, $p < .001$; and symptoms of PI/TBI and combat exposure explained 2%, R^2 change = .02, F change (3, 119) = 2, $p = .13$, of the variance in sleep disturbances. Thus, the total variance explained by the model as a whole was 48.4%, F (18, 119) = 8.14, $p < .001$. In the final model, three measures were statistically significant, with PTSD recording a higher β value (β = .30, $p < .01$) than rank, enlisted/specialized personnel, (β = .21−.22, ps < .05) or personal history of SD (β = .20, $p < .01$).

Table 11. Predictors of Sleep Disturbance in PD 2

	b	SE b	β
Step 1			
Constant	7.73	2.30	
Rank_E1E4	4.72	1.22	.38**
Rank_E5E6	3.59	0.94	.38**
Rank_E7W3	3.75	0.92	.35**
Step 2			
Constant	6.64	2.20	
Rank_E1E4	4.34	1.15	.35**
Rank_E5E6	3.36	0.88	.35**
Rank_E7W3	3.35	0.88	.31**
Gender	-1.73	0.74	-.18*
Personal History	2.90	0.65	.34**
Step 3			
Constant	5.50	2.01	
Rank_E1E4	2.25	1.05	.18*
Rank_E5E6	2.11	0.80	.22**
Rank_E7W3	2.37	0.79	.22**
Gender	-1.92	0.66	-.20**
Personal History	1.95	0.60	.23**
PTSD	0.86	0.26	.28**
Step 4			
Constant	6.09	2.02	
Rank_E5E6	2.00	0.82	.21*
Rank_E7W3	2.41	0.78	.22**
Personal History	1.72	0.61	.20**
PTSD	0.91	0.28	.30**

Note. Analysis conducted using hierarchical multiple regression.
R^2 = .26 for Step 1; ΔR^2 = .11 for Step 2; ΔR^2 = .17 for Step 3; ΔR^2 = .02 for Step 4 (*p*s < .01).
* < 0.05 ** < 0.01.
PSQI = Pittsburgh Sleep Quality Index, PTSD = Post Traumatic Stress Disorder, PSS = Perceived Stress Scale.

d. Limitations of study

This current study has several methodological limitations. First, all measures were self-report. As such, there is a recall bias of the quality and quantity of sleep. In addition, as noted in the high percentage of soldiers with PSQI >5, there may have been selection bias in relation to who chose to participate in the study. Thus, the true prevalence of sleep disturbances in soldiers returning from deployment may or may not be accurately represented. Second, this study did not use other well validated measures for PTSD, such as the Post Traumatic Checklist-17, or for depression, such as Beck Depression Inventory. In addition, a validated measure for anxiety would have been beneficial since one of the most common reasons for sleep disturbances for participants listed under "others/comments" were "anxious" or "mind racing." Third, this study did not measure social and work related environmental risks such as support system, cohesion, and leadership of the unit. Furthermore, home/family interactions or other physical environmental risks such as possible exposure to biological or chemical exposures (e.g., chlorine gas, solvents, smoke, and sand/dust) based on soldiers' occupational specialties were not measured. These environmental factors can potentiate or modify sleep disturbances in this population. However, perceived stress of each participant was measured and reflective of other environmental and social stressors. Fourth, anecdotal evidence suggested that soldiers drink and/or take many different types and large quantities of caffeinated drinks/supplements, a possible preferred method to manage sleep disturbances especially for a decrease in sleep duration during deployment. Caffeine is a potent stimulant and can enhance motor and psychological skills in a sleep deprived state (Wesensten et al., 2002). Lastly, to reflect the possible role of frequent deployment in the development of sleep disturbances, the number of previous deployment experiences was not captured. Since the start of OEF/OIF, many soldiers have deployed to Afghanistan or Iraq more than one time. Prior deployments have shown to have impact on mental health status in NG soldiers (Polusny et al., 2009); thus, capturing the prior deployments on sleep disturbances need further investigation.

The population of this study is limited to U.S. soldiers in the greater Northwest. Thus, study findings may not be generalizable to other Army soldiers in different military bases or to other services such as the Air Force, Navy, or Marines because of the difference in the length and the type of deployed environment. Finally, there is no comparison group of soldiers who have never deployed, so causality cannot be made. However, the purpose of the study was to describe the prevalence of sleep disturbances in soldiers who have deployed and returning back to the United States.

IX. Conclusion and Implication

a. Summary of results with emphasis on importance and/or implications of completed research.

The results of this study showed that soldiers who deployed to either Afghanistan or Iraq had a high prevalence of sleep disturbance after they returned from a 5-month deployment. Overall, PSQI global scores were greater than 9 and subscales of PSQI revealed problems in sleep quality, sleep latency, sleep duration, sleep disturbances (e.g., temperature, coughing, use of the bathroom, etc.), and daytime dysfunction at both time points and sleep problems persisted 1.5 months after returning from deployment. Daytime dysfunction was worse 1 1/2 months after initial assessment. Daytime dysfunction was the only subscale that was statistically significant at PD 2 even though the sleep latency (frequency and/or time to fall asleep) slightly improved but a slight decrease in the use of medication may have potentially affected the daytime dysfunction. It is interesting to note participants reported not using sleeping medication at PD 1 or PD 2 frequently, in light of the fact that the global PSQI score was high at both time points. Medication usage for sleep might be more acceptable and accessible in a deployed environment; however, might have the potential to interfere in the mission; whereas the medication usage for sleep in the state-side environment might have perceived as not warranted. In addition, alcohol was not readily available to soldiers to use as a "sleep aid" while deployed, a common finding in the study of young adults in the

civilian population (Jefferson et al., 2005; Johnson et al., 1998); thus, the use of alcohol to aid in sleep in the state-side might have been utilized more frequently leading to less use in medication for sleep in the state-side environment.

There was a low to moderate and statistically significant correlation between mean PSQI global scores and a personal history of sleep disturbance, PTSD score, depression score, PSS, symptoms of physical illness, and symptoms of TBI after controlling for age, gender, and rank (a surrogate for SES in military studies). This is contrary to findings by Ohayon (2009) that revealed that a higher prevalence of insomnia in women and in association with increased age, and single/divorced status among a civilian population. However, findings of higher mean PSQI global score in the enlisted rank (an indicator of lower SES) compared with officer ranks is similar. At PD 2, after controlling for age, gender, and rank, there continued to be a low to moderate and statistically significant correlation between PSQI global scores and above six factors. This suggests that age, gender, and rank had a somewhat moderating effect on the strength of the relationship between PSQI global scores and these six factors.

Using hierarchical multiple regression, rank (E1−W3, lower to higher grade enlisted/specialized personnel), personal history of SD, perception of stress, and symptoms of physical illness made significant contributions at PD 1 to the prediction of sleep disturbances. Rank (E4 −W3, mid- to higher grade enlisted/specialized personnel), personal history of SD, and PTSD made significant contributions at PD 2. Initially, perception of stress and symptoms of physical illness had significant contributions at PD 1; however, at PD 2, these factors did not contribute. Conversely, PTSD was not contributing factor at PD 1 but was a factor in PD 2 as a predictor in sleep disturbances. Thus, the combination of rank and personal history of sleep disturbances might be factors that might be most indicative of sleep disturbances in the trajectory in the assessment of sleep disturbances.

As with other studies in the civilian population (Dauvilliers et al., 2005; LeBlanc et al., 2007), a personal history of sleep disturbance had a consistent association with sleep disturbances in soldiers who have deployed. A history of sleep disturbances was consistently moderate and positively correlated with the PSQI global both at PD 1 and PD 2, after controlling for age, gender, and rank and contributed greatly to the final model in the predication of sleep disturbances at both time points. Thus, a history of sleep disturbances might be an early indicator of those who are vulnerable for sleep problems after deployment. However, based on how the question was worded, it is not known when previous episodes of sleep problems occurred or the duration of the problem. A thorough assessment prior to deployment would identify those individuals with a vulnerability to develop sleep problems during deployment. Effective interventions such as cognitive-based therapy (CBT) are available and might be beneficial for soldiers. CBT components such as relaxation and sleep hygiene might be a “portable” intervention option in a deployed environment. Because the high prevalence of poor sleep, future studies are needed to assess the extent of personal history of sleep problems among all military personnel.

In PD 1, the rate of PTSD and depression (13% and 8%, respectively) was consistent with findings from military studies (Hoge et al., 2006) which report the rates of PTSD from 12−35% and depression from 4−13% in soldiers who have returned from deployment; however, in PD 2, the rate was higher. The majority of participants who had a positive screen for PTSD or depression had PSQI >5, indicating they were all poor sleepers. However, it is important to note that those who did not screen positive for PTSD or depression also had high percentage of sleep disturbances.

Overall, an association between perceived stress and sleep disturbances is consistent with a study by LeBlanc et al. (2007). It was moderately significant after controlling for age, gender, and rank. Even though officers (higher rank) might be exposed to more stressful experiences and problem solving situations related to leadership, perceived stress was still significant indicating that rank had only slight moderating factor in relationship to sleep disturbance. In PD 1, perceived stress recorded higher

contribution to the prediction of sleep disturbances than symptoms of physical illness, personal history of sleep disturbances, and rank. Nevertheless, total mean scores for perceived stress at PD 1 and PD 2 (17.4 and 16.5, respectively) were higher than the mean score of the general population (13.3) (Cohen & Williams, 1988). The scores of PSS were below the normality mean score in those with PSQI ≤5 and the scores of PSS were above the normal mean score in PSQI >5 at both time points suggesting that perhaps those with sleep disturbances have a greater propensity to evaluate and perceive stressors at a higher level – a trait-like characteristic.

The use of alcohol was very low in deployed soldiers initially after returning from deployment. This was consistent with the fact that alcohol use is prohibited during deployment. However, even after approximately two months later, the positive endorsement to the alcohol was still very low. Yet, anecdotal evidence suggests that both young and older soldiers use a large quantity and they frequently use alcohol for recreational purposes. The two questions used in this study asked the soldiers if they perceive that they have a problem with alcohol. Future studies should include questions on alcohol usage, along with dosage and frequency. An addition of these questions will reflect the objective use of alcohol, instead of perceived problems with the use of alcohol.
There was a strong correlation between a PSQI global score and symptoms of physical illness and TBI. However, since the symptoms of TBI were a subset of the symptoms of physical illness, there was a high correlation. Thus, further analysis is warranted to determine the best way to capture the true symptoms of TBI such as using a specific and thorough TBI symptoms checklist. As with many studies on physical illness (Katz & McHorney, 1998; Ohayon, 2005; Ouellet et al., 2004), symptoms of physical illness had a significant association with and a predictor of sleep disturbances at PD 1.

b. Suggestions for future research to better address the research topic.

This study is unique in that it is the first study that focuses on sleep within a group of healthy, uninjured soldiers after deployment at two different time points using a valid measure for sleep disturbance. The dynamic interaction of individual vulnerabilities of sociodemographic factors, sleep history, psychological factors, symptoms of PI/TBI with the environmental risk of combat exposure contributes greatly to the health response of sleep disturbances in solders returning from deployment. Longitudinal studies are needed to determine the course of sleep disturbances as well as the timing of assessment and intervention to effectively manage sleep disturbances in this population. This study is the initial step toward improving assessment and treatment of disturbed sleep that may ultimately improve health outcomes.

Significance of Research to Military Nursing

In summary, poor or insufficient sleep is linked to impaired cognitive and immune functions; decreased quality of life, and increased accidents and increased mortality. Individual vulnerability factors and environmental risks that influence sleep disturbances are multidimensional and interrelated. Sleep disturbances are well established in the civilian population as both a risk factor for and as a symptom of psychiatric disorders (PTSD, anxiety, and depression). Studies on deployed military personnel have focused on the prevalence of psychiatric disorders related to PTSD, anxiety, and depression. However, limited data are available on the extent of sleep disturbances in soldiers returning from deployment and the multifaceted relations among sleep, vulnerability factors, and environmental risks. Treatments are readily available for most types of sleep disturbances. Hence, an early assessment and identification of sleep disturbances by military nurses and other healthcare providers can ensure timely treatments for soldiers with disturbed sleep and those at risk for persistent sleep disturbances and psychiatric problems.

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Outcomes Resulting From Study:

Abstracts or Other Materials :

16th Biennial Phyllis J. Verhonick Military Nursing Conference, San Antonio, TX, April 2009 (Madigan Army Medical Center PAO clearance obtained 12 March 2010).

24th Annual Sleep Conference, San Antonio, TX, June 2009 (Madigan Army Medical Center PAO clearances obtained 26 February 2010)

Presentations

16th Biennial Phyllis J. Verhonick Military Nursing Conference, San Antonio, TX, April 2009 (PAO clearance as above)

24th Annual Sleep Conference, San Antonio, TX, June 2009 (PAO clearance as above)

Press Coverage

24th Annual Sleep Conference, San Antonio, TX, June 2010; press release by the American Academy of Sleep Medicine for abstract titled, "Sleep disturbances in U.S. Soldiers returning from wartime deployment: preliminary findings." (Madigan Army Medical Center and Landstuhl Regional Medical Center PAO clearances obtained 26 February 2010).

APPENDIX A

Final Budget Report

CATEGORY	ORIGINAL AWARD	REALLOCATIONS	EXPENSED AT END OF STUDY	REMAINING AMOUNT
Personnel				
Consultant		$1,912.50	$1,912.50	$0.00
Equipment				
Supplies	$3,405.00	$25.34	$3,430.34	$0.00
Travel	$4,527.00	$359.77	$4,404.14	$482.63
Patient Care Costs				
Other Expenses	$6,915.00	($2,297.61)	$4,617.39	$0.00
Indirect	$2,955.00		$2,858.50	$96.50
TOTAL	$17,802.00	$0.00	$17,222.87	$579.13

Discussion:

The reallocations for this study include a reallocation approved by TSNRP via modification 4. This reallocation approval was to move $1,800.00 from the Other category to the Consultant category and to move $669.55 from the Other category to the Travel category to support the Principal Investigator's travels to the PJV Conference and SLEEP 2010 24th Annual Meeting.

APPENDIX B

Problems Encountered, Resolutions

1. Unanticipated event was experienced with obtainment of signature from the JAG officer after approval of the protocol in Oct 08 by Madigan Department of Clinical Investigation. A signature was needed for both the protocol and Cooperative Research and Development Agreement (CRADA) from the JAG officer prior to sending the protocol to Medical Command CIRO per review, per AR 40-38. The protocol and CRADA were signed as of December 16, 2008.

2. After the start of recruitment in March 2009, there was a low number of Soldiers who were eligible for the study based on the 9-month inclusion criteria. Therefore, an amendment to Madigan and UW IRB was submitted to change the inclusion criteria to 5 months especially for medical personnel who deploy for 5-6 months. In addition, recruiters (from MAMC Nursing Research Service) were added to ensure optimal recruitment of Soldiers during high Soldier-volume at SRP site or in the absence of PI/AI.

3. The PI has successfully defended and received her PhD in August 2009 and had a Permanent Change of Station to Landstuhl, Germany at the end of September 2009. However, the initial recruitment goal of 300 Soldiers was not met prior to the original study end date of 30 June 2009. A no-cost extension until 30 June 2010 was approved by TSNRP and a PCS plan was initiated to continue and complete the recruitment goal of 300.

APPENDIX C
Psychometric Report
Reliability and Validity of Measures

If no instrumentation was used for your study, check here ☐

Directions: Please complete the questions below addressing demographic characteristics of your sample and overall sample size. For the tool identified in the attached cover letter, please complete the following questions regarding any reliability and/or validity testing you performed. Please note that this list is not meant to be exhaustive. If you performed other reliability and/or validity testing which is not listed, please identify the test, and report your findings under "other." If further space is needed, please attach additional pages. Please submit a copy of the tool if you made any modifications.

Principal Investigator – Contact Information

Name:	**Betty Garner**	**Telephone**	**DSN (314) 590-5641**	**Work**
Address:	**CMR 402 PO Box 1187**	**Number:**	**(011 49) 170 383 4323**	**Home**
	APO, AE 09180	**E-mail:**		
Title of Study	Sleep Disturbances in U.S. Army Soldiers After Deployment to Afghanistan or Iraq			

Demographic Characteristics of Sample

Total sample size:		**Age Range:**	**18-60**			**Number**	**Service**
	<19 yrs	19-60 yrs	>60 yrs	Other (missing)		274	Army
Male	6	**195**	**0**	**4**		0	Air Force
Female	**2**	**71**	**0**	**0**		0	Navy
						0	Marine

Number	**Race:**			**Number**	**Service Component:**
201	Caucasian			205	Active Duty
36	African-American			0	Retired
0	Hispanic			49	Reserve
5	Asian/Pacific Islander			20	National Guard
36	Other (American Indian 4/Asian 14/missing data 17)			0	Dependent

Briefly describe defining characteristics of sample:

The majority of the sample was male, enlisted in the ranks of E1 to E9, Caucasian, and married. In addition, the majority of ants was AD and deployed to Iraq. Soldiers who completed PD 1were on average 32 years of age (*SD* = 8 years; range, 18−60). oldiers had an average length of deployment of 350 days (*SD* = 88 days; range, 153−537). For PD 2, participants between service ents were almost equivalent and were on the average 34 years of age (*SD* = 9 years; range, 18−60). These soldiers were deployed verage of 340 days (*SD* = 91 days; range, 153−537).

Instrument Reference						
Instrument Title:	**Pittsburgh Sleep Quality Index (PSQI)**				**Number of Scales:**	**1**
Instrument Publication Year:	**1989**				**Edition:**	**1**
Authors:	**Buysse, D. J., Reynolds, C. F., 3rd, Monk, T. H., Berman, S. R., & Kupfer, D. J.**					
Publisher:						
Journal or Book Title:	**Psychiatry Res**					
Year:	**1989**	**Volume:**	**28**	**Page Numbers:**	**192-213**	
Tool Modifications						
Did you modify this tool?	**✓Yes (Answer A & B below)**			**☐ No**		
A. Briefly describe why modifications were made:	The order of question was modified to better facilitate the answer choices. The scoring or wordings of the questions were NOT modified.					
B. Describe what modifications were made (attach page if additional space is needed):	**N/A**					

Instrument Reference						
Instrument Title:	**Primary Care-Post Traumatic Stress Disorder Screen (PC-PTSD)**				**Number of Scales:**	**1**
Instrument Publication Year:	**2003**				**Edition:**	**1**
Authors:	**Prins, a., Ouimette, P., Kimerling, R., Cameron, R. P., Hugelshofer, D. S., Shaw-Hegwer, J., et al.**					
Publisher:						
Journal or Book Title:	**Primary Care Psych**					
Year:	**2003**	**Volume:**	**9**	**Page Numbers:**	**9-14**	
Tool Modifications						
Did you modify this tool?	**☐ Yes (Answer A & B below)**			**✓ No**		
A. Briefly describe why modifications were made:	**N/A**					
B. Describe what modifications were made (attach page if additional space is needed):	**N/A**					

Instrument Reference							
Instrument Title:	**2-item Patient Health Questionnaire (PHQ-2)**					**Number of Scales:**	**1**
Instrument Publication Year:	**2004**					**Edition:**	**1**
Authors:	**Corson, K., Gerrity, M. S., & Dobscha, S. K.**						
Publisher:							
Journal or Book Title:	**Am J Manag Care**						
Year:	**2004**	**Volume:**	**10**	**Page Numbers:**	**839-845**		
Tool Modifications							
Did you modify this tool?	☐ **Yes (Answer A & B below)**			✓ **No**			
A. Briefly describe why modifications were made:	**N/A**						
B. Describe what modifications were made (attach page if additional space is needed):	**N/A**						

Instrument Reference							
Instrument Title:	**2-item alcohol usage (ETOH)**					**Number of Scales:**	**1**
Instrument Publication Year:	**2001**					**Edition:**	**1**
Authors:	**Brown, R. L., Leonard, T., Saunders, L. A., & Papasouliotis, O.**						
Publisher:							
Journal or Book Title:	**J Am Board Fam Pract**						
Year:	**2001**	**Volume:**	**14**	**Page Numbers:**	**95-106**		
Tool Modifications							
Did you modify this tool?	☐ **Yes (Answer A & B below)**			✓**No**			
A. Briefly describe why modifications were made:	N/A						
B. Describe what modifications were made (attach page if additional space is needed):	**N/A**						

Instrument Reference							
Instrument Title:	**Perceived Stress Scale-10 (PSS-10)**					**Number of Scales:**	**1**
Instrument Publication Year:	**1983**					**Edition:**	**1**
Authors:	**Cohen, S., Kamarck, T., & Mermelstein, R.**						
Publisher:							
Journal or Book Title:	**J Health Soc Behav**						
Year:	**1983**	**Volume:**	**24**	**Page Numbers:**	385-396		
Tool Modifications							
Did you modify this tool?	☐ **Yes (Answer A & B below)**			✓ **No**			
A. Briefly describe why modifications were made:	N/A						
B. Describe what modifications were made (attach page if additional space is needed):	**N/A**						

Instrument Reference					
Instrument Title:	**Combat Exposure Scale (CES)**			**Number of Scales:**	**1**
Instrument Publication Year:	**1989**			**Edition:**	**1**
Authors:	**Keane, T. M., Fairbank, J. A., Caddell, J. M., Zimering, R. T., Taylor, K. L., & Mora, C. A.**				
Publisher:					
Journal or Book Title:	**J Consult Clin Psychol**				
Year:	**1989**	**Volume:**	**1**	**Page Numbers:**	53-55

Tool Modifications		
Did you modify this tool?	☐ **Yes (Answer A & B below)**	✓ **No**
A. Briefly describe why modifications were made:	N/A	
B. Describe what modifications were made (attach page if additional space is needed):	**N/A**	

Directions: Please indicate any reliability and/or validity testing you did on this instrument. Please report findings of each scale next to the test.

Check all that apply

Reliability		Validity
☐ Internal-Consistency Reliability		Content Validity
✓ Cronbach Coefficient Alpha		☐ Index of Content Validity (CVI)
☐ Kuder- Richardson (KR-20)		☐Other (please describe on back of form)
☐ Interrator Reliability		Criterion-Validity
☐ Intrarater Reliability		☐ Predictive
☐ Coefficient of Stability (test-retest)		☐ Linear Correlation
☐ Coefficient of Equivalence		Name of Criterion Measure Used:
☐ Other (please describe on back of form)		☐ Concurrent
		☐Linear Correlation
Reliability of Individual Scales		Name of Criterion Measure Used:
Scale Name	**Reliability**	☐ Construct Validity (include a copy of findings)
PSQI	**.727**	☐ Multitrait-Multimethod
PC-PTSD	**.829**	☐ Hypothesis testing
PHQ-2	**.860**	☐ Contrasted Group
ETOH	**.560**	☐ Factor Analysis
PSS-10	**.881**	☐ Exploratory
CES	**.666**	☐ Confirmatory
Please use back of form for additional scales		☐ Other (please describe on back of from)

Evaluation of Measure

Would you recommend the use of this measure in your population to other researchers? Use extra page, if needed.

✓ Yes. Please explain why.	**PSQI: One of the most widely used instrument in sleep research; however, missing data for 1st 4 questions possibly due to soldiers who have variable sleep wake-up and sleep time based on mission.** **PC-PTSD and PHQ-2: Brief and easy to use; decreased participant burden; used as a screening questions and not as a diagnostic measure.**

	PSS-10: Brief instrument to measure perceived stressed vs. life events.
✓ No Please explain why.	**ETOH: Brief but not objective as other measures. Inconsistency between the 2 questions vs. # of drinks (i.e. 5 cans of beer per night but checks do not have drinking problem)** **CES: wordings are outdated and not congruent with currently asymmetrical welfare.**

APPENDIX D

Research Categorization Using TSNRP Areas of Research

Identify the main research priority investigated in this research study.
Please check one item for Primary (Required) and one item for Secondary Priority Areas (if appropriate)

Primary Research Priority Area: (Required)

X Military Deployment Health

___ Translating Knowledge & Research Findings into Practice in a Military Context

___ Evidence Based Practice

___ Recruitment & Retention of the Military Nursing Workforce

___ Developing & Sustaining Military Nursing Competencies

Secondary Research Priority Area:

X Military Deployment Health

___ Translating Knowledge & Research Findings into Practice in a Military

___ Evidence Based Practice

___ Recruitment & Retention of the Military Nursing Workforce

___ Developing & Sustaining Military Nursing Competencies

Other *(fill in)* _____

Identify 3-5 key words relating to the proposal. (Required)
(You MUST use the *CRISP Thesaurus* for key words. The thesaurus is on the web at:
http://crisp.cit.nih.gov/crisp/crisp_help.help

1. sleep
2. mental health
3. military personnel
4.
5.

APPENDIX E

Do you have any articles or presentations 'in press' ☐ **yes** ☒ **no**

If yes, provide copies and all PAO clearance information. All citations listed must be in APA format.