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UNIVERSITY OF SAN DIEGO

Hahn School of Nursing and Health Science

DOCTOR OF PHILOSOPHY IN NURSING

Chronic Pain, Sleep Disruption, and Work Performance in the Military

by

Jeffrey Charles Ransom

A dissertation presented to the

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requirements for the degree

DOCTOR OF PHILOSOPHY IN NURSING

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Dissertation Committee

Dr. Joseph F. Burkard, Chairperson

Dr. Sally Brosz Hardin

Dr. Emmanuel P Espejo

UNIVERSITY OF SAN DIEGO

Hahn School of Nursing and Health Science
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CANDIDATE'S
NAME:

Jeffrey C. Ransom

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DISSERTATION
COMMITTEE:

Joseph F. Burkard, DNSc, CRNA, Chairperson

Sally Brosz Hardin, PhD, RN, FAAN, Committee Member

Emmanuel P. Espejo, PhD, Committee Member

Abstract

Background and Significance: Managing pain is a challenge for many organizations, including the U.S. military. The added complication of managing sleep disruption compounds the issue. Examining pain and sleep disruption in the context of work performance within the military is critical to understanding the impact of these conditions on our nation's fighting forces.

Purpose: Examine the associations of chronic pain and sleep disruption in the context of work performance among active duty military service members.

Research Aims: 1) Describe sociodemographic characteristics, military service characteristics, clinical characteristics, and work performance of active duty service members, 2) Examine relationships between these characteristics, and work performance, and 3) Determine what characteristics increase task performance and contextual performance, and decrease counterproductive work behavior.

Design: A cross-sectional observational study that examines associations between patients with chronic pain and sleep disruption, in the context of work performance.

Methods: Subjects were recruited and consented from the empaneled pain management clinic. Participants completed a single visit in which self-reported demographics, pain status, sleep status, and work performance were captured.

Findings: 145 participants completed the study. Females accounted for 27.6% ($n = 40$) of participants, exceeding the 14.4% overall military average. Special Forces participants had higher levels of opioid use and depression compared to the rest, but demonstrated better work performance. Age, depression, and sleep were consistently strong predictors of work

performance. Patients performed better with age, while those with depression and sleep disruption performed poorly.

Implications: A closer look at the Special Forces population in the context of pain, sleep, and work performance could provide a better understanding of how these patients cope with pain and sleep disruption. Research focused on the differences in work performance among age groups may provide a better understanding of coping strategies. Focused depression research can lead to a greater understanding of how mental health impacts pain, sleep, and work. Overall, this study revealed some interesting relationships that may lead to interventions within this population. The findings of this study opens the door to explore multiple approaches that could lead to treatments and preventions for military members suffering from chronic pain.

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CHAPTER I

Introduction

The U.S. military is currently under tremendous strain to ensure its members are prepared to meet the demands of global missions at an operational tempo rarely seen before.

Understanding and addressing the needs of people suffering from chronic pain has never been more important. This issue is uniquely challenging for the U.S. military and its need to maintain mission readiness at all times. The patient population consists of relatively young and active members who are at an increased risk for injury based on the very nature of their occupations as warfighters. These injuries are the major reason personnel are not deployable within the Armed Forces. Pain is the most prevalent symptom among these patients. Managing pain without further complicating recovery with medication side effects, dependence, or even addiction is critical to properly addressing this crisis. Furthermore, sleep disruption often accompanies the chronic pain diagnosis and further complicates treatment. The purpose of this study is to examine the associations between chronic pain and sleep disruption in the context of work performance among active duty service members.

Specific Aims are to: 1) To describe sociodemographic characteristics (age, gender, race, marital status), military service characteristics (rank, branch, occupation, duty status, special forces status), clinical characteristics (BMI, opioid use, pain status, sleep status), and work performance of active duty service members attending the Naval Medical Center San Diego (NMCS) Pain Management Clinic, 2) To examine the relationships between sociodemographic characteristics (age, gender, race, marital status), military service characteristics (rank, branch, occupation, duty status, special forces status), clinical characteristics (BMI, opioid use, pain

status, sleep status), and work performance of active duty service members attending the Naval Medical Center San Diego (NMCSD) Pain Management Clinic, and 3) To determine what sociodemographic characteristics (age, gender, race, marital status), military service characteristics (rank, branch, occupation, duty status, special forces status), and clinical characteristics (BMI, opioid use, pain status, sleep status), increase task performance and contextual performance, and decrease counterproductive work behavior of active duty service members attending the Naval Medical Center San Diego (NMCSD) Pain Management Clinic.

Background and Significance

Effectively managing pain is a challenge for many organizations, including the U.S. military. Recent statistics show that 44% of all U.S. service members suffer from chronic pain after a combat deployment, compared to 26% of the general public ("Fighting pain in the military," 2017). Additionally, service members are not immune to the consequences of the current opioid epidemic. Opioid use among post-combat deployment service members is a staggering 15%, compared to 4% among the general public (Jonas & Schoomaker, 2014). The patient population consists of relatively young and active members who are at an increased risk for injury based on the very nature of their occupations as warfighters. These injuries are the major reason personnel are not deployable within the Armed Forces. Pain is the most prevalent symptom among these patients. Managing pain without further complicating recovery with medication side effects, dependence, or even addiction is critical to properly addressing this crisis.

Furthermore, managing sleep disruption among this military chronic pain population compounds the issue dramatically. While there are numerous studies that identify and address relationships between pain and sleep disruption, there is little research that examines these factors in the active duty military population. A 2013 study of post-combat deployment of military members did show that there is a significant relationship between sleep disorders and pain syndromes (Shattuck & Brown, 2013). Additionally, while it is possible for sleep and pain to be mutually exclusive, studies reveal that there is a reciprocal relationship between the two conditions among patients who suffer from chronic pain (Edwards, Almeida, Klick, Haythornwaite, & Smith, 2008); (Generaal, Vogelzangs, Penninx, & Dekker, 2017); (Jungquist et al., 2010); (Tang, 2008).

Examining pain and sleep disruption in the context of work performance among military service members is critical to understanding the real impact of these conditions on our nation's fighting forces. While studies reveal an association between insomnia and work performance (Kessler et al., 2011), there has been no research that has examined relationships between sleep, pain, and work performance, specifically in the military setting. The military currently faces an extremely high operational tempo that demands frequent deployments to foreign nations. Unfortunately, it also faces an unprecedented increase in non-deployable service members. This increase is having a critical effect on mission readiness and threatens capability both at home and abroad, as well as presenting a national security risk. The Department of Defense currently is struggling to deal with more than 280,000 non-deployable troops, roughly 14 percent of our active military force (Maucione, 2018). The majority of these cases are health-related, many of whom suffer from chronic pain and sleep disruption.

Research focused on examining and understanding the relationships and nuances of pain and sleep in the context of work performance among military service members may provide valuable insight regarding this unique patient population. An obvious gap in research exists related to the topics of pain, sleep, and work performance throughout the Department of Defense. The current observational study will guide and inform future interventional studies of these constructs with the potential for positive impact on the lives of military warfighters, mission readiness, and overall military productivity.

CHAPTER II

Review of Literature

Literature related to chronic pain and sleep disruption, including their relationship to each other, is vast. However, these conditions are not well studied among the military population. The majority of military studies that include these two conditions have other specified aims, with indirect or non-specific outcomes that encompass pain and sleep. Nonetheless, the findings from many of these studies bear relevance to the purposes of this research. Furthermore, studies focused on these two topics and their relationship to work performance is extremely limited, with no research dedicated to examining the effects of work performance among chronic pain patients in the military who suffer from sleep related disorders. Similarly, there are studies that examine work and job performance that do not necessarily include comorbid diagnoses of chronic pain and/or sleep related disorders. As with the pain and sleep studies, these work performance studies have applicability to this research topic.

Pain in the Military

Effectively managing pain is a challenge for many organizations, including the U.S. military. As with its civilian counterparts, military medicine is currently working on strategies and solutions to curtail prescription opioid use while adequately managing pain among service members. In a study that examined ways to address pain as a barrier to human performance by changing the approach to pain management, Buckenmaier and colleagues conducted a study (Buckenmaier III, Galloway, Polomano, & Deuster, 2016) aimed at characterizing pain using the Defense Veterans Pain Rating Scale (DVPRS). The DVPRS measures functionality rather than a simple subjective number associated with the traditional visual analog scale for pain. The study

suggests that the DVPRS is better suited for understanding pain among the military special operations community and allows for appropriate and effective complimentary integrative medicine strategies to be prescribed based on these functional impairments, rather than defaulting to an opioid prescription as the standard of care. The study revealed decreased pain levels and improved functional outcomes among the special operations group and suggests similar expectations for the broader military population.

Bader and colleagues conducted an integrative review (Bader, Giordano, McDonald, Meghani, & Polomano, 2018) of 26 research articles dating between 2001 and 2016 that examined musculoskeletal pain, and included active duty military participation. The purpose of this review was to examine incidence, prevalence, and risk factors for musculoskeletal pain (MSP) and headaches among the active duty military population. The study revealed that 82% of all injuries among non-deployed military personnel was related to low back pain and inflammation from overuse. Risk factors associated mostly closely with MSP included active duty status, female gender, Army, enlisted personnel, and those who spent a significant amount of time in a motor vehicle. Some of the studies were limited by small sample sizes, and data on battlefield injury and treatment was not included. However, the review adequately demonstrates the pervasiveness and significance of MSP among service members.

Edwards and colleagues (Edwards, Almeida, Klick, Haythornwaite, & Smith, 2008) published study results which suggest that hours of sleep at night is a predictor of pain levels during the following day. The study, which included 971 adult participants who self-reported sleep hours and pain levels daily for one week, revealed that obtaining either less than six hours or more than nine hours of sleep was associated with greater next-day pain. Additionally, pain levels were significant predictors of sleep duration. The study cited previous research which

suggested reciprocal relationships between pain and sleep, but none had established a correlational relationship between pain and night to night sleep in the general population. The study highlights the importance of considering and addressing sleep disruption when managing pain patients.

Sleep Disruption

There are many studies that demonstrate a reciprocal relationship between pain and sleep. While the presence of neither condition necessarily implies the presence of the other, the presence of sleep disruption among patients suffering from chronic pain is extremely common. Although it is quite possible to experience sleep disruption in the absence of pain, some experts would argue that the presence of chronic pain almost certainly leads to sleep difficulties. With that said, studies demonstrate that, in the presence of both conditions, each makes the other worse.

Many studies have examined the relationships between sleep duration and pain. Generaal et al. conducted a study (Generaal, Vogelzangs, Penninx, & Dekker, 2017) with the purpose of evaluating the temporal relationship among sleep duration, depressive symptoms, and multisite musculoskeletal pain onset. The study included 1860 subjects in the Netherlands who were part of a larger depression and anxiety study. The participants were free from chronic multisite musculoskeletal pain at baseline, and were followed for more than six years. The study showed that patients with insomnia and short sleep duration in this population were significantly more likely to develop chronic pain. This study not only further highlights the importance of considering sleep quality in the treatment and management of chronic pain, but also suggests that depression may be an element of the chronic pain/ inadequate sleep phenomenon.

A large study published in 2018 by Wei et al. demonstrated and highlighted the comorbid relationship between pain and sleep (Wei, Blanken, & Van Someren, 2018). The study included 3,508 participants and demonstrated a mutual reinforcement of worsening pain and decreasing sleep quality among this sample. The study showed that participants suffering from chronic insomnia experienced an increase in pain reactivity and poor sleep quality. Patients also showed an analogous effect of severe chronic pain on sleep quality. Interestingly, with acute symptoms pain was far worse after a bad night's sleep than improved following a good night's sleep. Similarly, sleep was far worse following a worsened pain episode than was improved following a particularly better pain experience. While the mechanism of the modulating effect of each condition on the other remains unknown, this study clearly demonstrates the presence, prevalence, and reciprocal relationships of pain and sleep. Furthermore, it expands on previous research that demonstrates broader linkage between the two conditions, such as Tang's 2008 study, which examined the pain-sleep relationship and potential treatment options (Tang, 2008).

For the purposes of this study, the Pittsburgh Sleep Quality Index (PSQI) was chosen as the instrument of choice to examine sleep disruption. Given the extensive available research and published literature on the PSQI and numerous other means to examine sleep behavior, including actigraphy and polysomnography, an extensive psychometric evaluation was performed in order to provide additional support for choosing the PSQI for this study.

PSQI Psychometric Evaluation

A literature search was conducted using PUBMED. There were no date limitations for the search. Additional hand searches and secondary reference searches were also conducted. Searches were limited to English language and peer reviewed journals. The Medical Subject Headings (MESH) terms were applied to search terms and a search using the Boolean operator

was conducted with the following search terms: *Pittsburgh Sleep Quality Index, PSQI, sleep, disruption, systematic review, AND meta-analysis*. Select records from the database search were downloaded into a reference management program.

Database search returned 89 articles. No duplicates were returned during the initial search. All articles referenced were evaluated for relevance based on the articles titles, listed subjects, and abstract. All but nine were dismissed based on currency, psychometric relevance, and comprehensive scope. A full text review of the remaining nine articles was conducted. Full texts were obtained, reviewed, and assessed by one independent researcher (the author of this paper). The articles were evaluated to ensure they addressed reliability and validity testing of the PSQI instrument. An additional eight articles were then excluded due to a more recent meta-analysis that not only provided a more comprehensive and robust psychometric evaluation, but includes four of the remaining articles.

The selected study for this evaluation is titled “The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis” by (Mollaveva et al., 2015). As stated, the article is a systematic review and meta-analysis that gauges the PSQI instrument as a screening tool for sleep disruption in clinical and non-clinical settings. Furthermore, the article provides a comprehensive psychometric evaluation of the instrument in clinical and non-clinical contexts. Specifically, of the 37 studies that was chosen and reviewed: 22 examined construct validity; 19 known-group validity; 15 internal consistency; and three test-retest reliability.

1. Internal Consistency

Cronbach's Alpha was reported in 12 studies. All but 3 met the cut-point for a positive rating for within, and between group comparisons ranging from 0.70 to 0.83. No studies reported Cronbach's alpha within the ideal range for use in individual patients. The three studies that reported results below 0.70 featured patients with chronic fatigue syndrome and non-clinical samples.

2. Test-retest Reliability

Test-retest validity is evaluated in three studies. One study reported the intraclass correlation coefficient, the preferred statistic, another reported PCC, and the third reported both. The Renner-Sitar et al study featured patients with temporomandibular d/o with an ICC of 0.86 for a period of two weeks between test-retest. Buysse et al reported a PCC of 0.82 with a healthy, depressed, and sleep disordered patients, with all but depressed group showing significant differences between test and retest, a mean period of 28d. Knutson et al reported an ICC of 0.81 for the population based sample of early middle-aged adults, with 0.79 and 0.83 for white and black women, respectively, and 0.70 and 0.83 for black and white men, respectively. A PCC of 0.68 was reported. All ICC reports met the required cutoffs for groups, but not individuals.

3. Validity

This study addresses and evaluates validity through the application of convergent, divergent, and known-group validity measures. Convergent validity is a subtype of construct validity and refers to the degree to which two measures that should be related, are in fact related ("Convergent Validity," 2020). The purpose of divergent validity is to compare a test, or item, to another test. It is important to determine if a test is too similar to another test to ensure both aren't measuring the same thing. Divergent validity is present when two opposite items yield

opposite results ("Divergent Validity," 2020). Lastly, known-groups validity is a measure which addresses the sensitivity of differences and similarities in various groups for a given test or instrument ("Known-Groups Validity," 2020).

4. Convergent Validity

A strong association was revealed between the PSQI total score and the Insomnia Severity Index (ISI) total score ($r=0.80$), sleep problems from symptom experience reports ($r=0.72-0.77$), short form-36 health survey vitality score ($r=0.74-0.77$), sleep restlessness score ($r=0.72-0.77$), and sleep efficiency score from the sleep diary ($r=-0.76$). Moderate associations were found between the PSQI and disability scores ($r=0.31-0.58$), depression ($r=0.50$), tension/anxiety ($r=0.36-0.62$), and confusion ($r=0.45-0.46$). There were possible associations between the PSQI and Polysomnography (PSG) data. The studies revealed insignificant or low correlation coefficients ranging from 0.11 to 0.3 for the apnea/hypopnea index, and 0.21 for the number of oxygen saturation events. Moderate correlation was reported between the PSQI global score and the PSG sleep maintenance ($\rho = -0.33$), sleep efficiency ($\rho = -0.34$), and microarousal index in younger ($\rho = 0.39$), but not older healthy adults. Actigraphy data revealed variability with only some researchers reporting significant findings.

5. Divergent Validity

The PSQI demonstrated evidence of divergent validity with minimal association with psychosocial constructs, spasticity bladder dysfunction, and psychopathology. Findings for each of these variables were not significant.

6. Known-Groups Validity

Overall, evidence for known-groups validity demonstrated strong results. Studies that featured PSQI global scores between healthy subjects and subjects with a variety of disorders or conditions with known associations with sleep impairment, demonstrated significant differences between groups. However, studies that looked at differences between groups of people (ie, age, sex, race, etc) showed non-significant differences.

7. Instrument Strengths

The PSQI demonstrates very good overall reliability for groups of otherwise healthy individuals. In terms of validity, studies demonstrate strong convergent and known-groups validity. Notably, validity appeared much stronger for the PSQI global score among a variety of groups.

8. Instrument Weaknesses

The most striking weakness of the PSQI is its relatively weak association with actigraphy, specifically polysomnography. However, while the PSQI is a subjective instrument intended to screen and assist with sleep disorder diagnoses; it's applicability as a self-report instrument is satisfactory. Additionally the seven subgroups, or domains, of the PSQI demonstrated acceptable validity, but much weaker than the instrument's global score. Also, the PSQI validity is somewhat reduced when introducing certain comorbidities and groups of demographics.

9. Further Testing

The PSQI has been studied widely for a host of studies that include stand-alone sleep focused research, and studies that include multiple other comorbidities. Additionally, the instrument is widely used as the ideal sleep disorder screening and diagnostic test for clinical settings, especially primary care. Perhaps more in-depth psychometric testing of the seven

subgroups, and within demographic groups are warranted to further understand the instrument's validity. Also, expanding testing to include research within focused comorbid settings could strengthen confidence.

10. Use in Military Chronic Pain Setting

As stated, this researcher is evaluating chronic pain, sleep disruption, and work performance in an active duty military setting. There is limited research related to sleep disruption in the military chronic pain environment, and there is no published research in the context of work performance. For the purposes of this study, the PSQI appears to be a good fit for evaluating sleep quality among chronic pain patients in the military.

Sleep disruption status will be quantified using the Pittsburgh Sleep Quality Index (PSQI). In validity and reliability testing for primary insomnia, the PSQI demonstrated overall score test-retest reliability of 0.87, with high correlations between sleep log data (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002). A later study that examined validity and reliability of the PSQI in a non-clinical sample essentially replicated the findings, with high correlations with sleep diaries and depression scales, but lower with actigraphy (Grandner, Kripke, Yoon, & Youngstedt, 2006). The PSQI is effective at differentiating good and poor sleep through the measure of seven domains: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disturbances; use of sleep medication; and daytime dysfunction over the past month. Individual item scoring consists of "0-3" options with "3" being the negative extreme of the scale. A global score is calculated, which determines overall good or poor sleep.

11. Summary

In summary, this study will address the crucial component of how the ever-growing chronic pain dilemma impacts mission readiness within the military. By examining relationships and effects of pain, sleep, demographic factors, and work performance, the study represents a first step in the understanding of this unique problem, and those impacted.

The potential impact of pain and sleep disruption on work performance among military service members might be immense. Recognizing the possible negative outcomes associated with these factors is critical to addressing the unique needs of this patient population.

Work Performance

Many civilian-based studies have been conducted in order to examine work performance in a variety of workplace settings, and including various potential contributing factors. Studies relevant to this research focus are as follows:

A 2011 study conducted among hospital nurses (n=77) examined the effects of fatigue on work performance. The findings demonstrated that nurses suffering from both acute and chronic fatigue reported poorer work performance. Additionally, nurses suffering from chronic fatigue perceived they were less alert and less able to concentrate when providing care to patients, as well as diminished ability to effectively communicate (Sagherian, Clinton, Huijter, & Geiger-Brown, 2017).

A 2016 study evaluated the effects of environmental stressors on work performance among 114 office workers by focusing on Inadequate Indoor Environmental Quality (IEQ) over the course of 8 months. The office workers completed a host of online surveys designed to assess environmental stress exposure and perceived work performance. The results demonstrated increasingly poorer levels of work performance with higher levels of environmental stress.

Specifically, IEQ had a negative impact on sleep, motivation, and one's ability to focus, causing the individual to be easily distracted. Furthermore, IEQ appeared to contribute to erosion in resilience and the ability to cope with additional task demands. The study suggests that improved IEQ results in small, but pervasive productivity in the workplace (Lamb & Kwok, 2016).

No relevant studies on work performance among military service members could be found. Therefore, significant gaps exist in the understanding of the effects of chronic pain and sleep disruption on work performance in this unique population.

CHAPTER III

Methodology

Theoretical Model

Given the complexity and multi-faceted impact of chronic pain on an individual, the Biopsychosocial theoretical model will be used to guide and underpin this research. This model addresses the link among biology, psychology, and socioeconomic factors (Engel, 1977). Historically, clinicians used a biomedical model to address clinical issues. The need for a more holistic and comprehensive approach gave rise to the Biopsychosocial model. GL Engel demonstrated the superiority of the Biopsychosocial model in a seminal study that contrasted it against traditional biomedical approaches (Engel, 1980). Specifically, the Biopsychosocial model has led to dramatic improvements in pain management therapies, cost effectiveness, and improved functionality and quality of life in chronic pain patients compared to other models (Gatchel & Howard, 2018).

Conceptual Framework

It has been clearly shown that there is a direct positive relationship between chronic pain and sleep disruption. Patients with worsened chronic pain tend to have poorer sleep, while chronic pain patients who suffer from worsened sleep tend to have higher pain levels. In the current research, sleep and pain status will serve as primary independent variables, while work performance will serve as the dependent variable. Additionally, if possible (considering the number of subjects enrolled and their demographic distribution), the study will examine the effects of demographic variables (age, gender, rank, ethnicity, marital status, branch of service,

military occupation, Body Mass Index [BMI], average number of hours worked per week in past month, and opioid use).

Figure 1

Conceptual Model

Study Design

This will be a cross-sectional observational study examining the relationship of pain, sleep status, and work performance, in a sample of military patients diagnosed with chronic pain who are enrolled in the outpatient Pain Management Clinic at the Naval Medical Center San Diego (NMCSD). If possible, the research will also examine the independent and joint effects of age, gender, rank, race, marital status, branch of service, military occupation (classified as either blue collar or white collar), BMI, depression, and opioid use.

The operational hypothesis is that patients with high levels of pain and sleep disruption will have significantly lower work performance than patients with low levels of pain and sleep disruption.

Inclusion Criteria:

1. Active military enrolled and receiving treatment in the outpatient Pain Management Clinic at NMCSO between May 1, 2020 and June 12, 2020.
2. A recorded “Diagnosis of Chronic Pain” (defined as any form of musculoskeletal pain which has been present and persistent for twelve or more weeks); and
3. 18 years and older.

Exclusion Criteria:

1. Currently pregnant.
2. Current or previous diagnosis of cancer, diabetes, schizophrenia, or bipolar disorder; and
3. Current or previous history of substance abuse.

Screening and Sampling Procedures

All patients who visit the clinic on or after May 01, 2020, and before June 12, 2020 for established, or follow-up visits, rather than first time visits, will be informed of the opportunity to participate in the study. Those who are interested will be asked brief screening questions by research staff in order to determine eligibility. Once eligibility is established, research staff will conduct a brief but thorough explanation of the study, and a detailed explanation of the consent form, for all who are qualified in terms of inclusion and exclusion criteria. The consenting process will be performed by research staff.

Once the consenting process is complete, participants will be formally enrolled in the research study. They will then immediately be given a study packet to complete. The study packet will consist of a demographic form, a pain scale, a sleep survey, and a work performance survey (see instrument details in Data Collection and Instrumentation section below).

Power Analysis

Using G*Power 3.1.9.6: F-test, Linear multiple regression: fixed model R^2 deviation from zero (R^2 increase is used for hierarchical regression), effect size = .15 (based on Cohen's criteria for regression, 1988, .02=small effect size, .15= medium, and .35=large), Alpha significance = .05, power = .80, and No. of predictors = 16. These selections yield a sample size of $N = 143$.

Figure 2

Operational Definitions

1. Chronic Pain is defined as any pain lasting more than 12 weeks; this is supported by virtue of enrollment in the NMCS D Pain Medicine Clinic.
2. Sleep disruption is defined as insufficient sleep to support adequate alertness, performance, and health, either because of reduced total sleep time or fragmentation of sleep by brief arousals.

3. Work performance is defined as the summed results of one's work efforts and behavior compared to the job requirements and responsibilities.

Recruitment

Research recruitment flyers will be distributed to Pain Medicine Department staff. The flyers will include a phone number for staff or potential subjects to contact research staff. The Pain Medicine Department staff will give the research phone number to potential subjects or alert research staff that a patient is interested in participating. Upon contact, a face-to-face appointment will be made with the potential subject in a private area within the Pain Medicine Department. At that meeting, details of the study will be discussed, patient questions addressed, and consent forms completed. All consenting and study procedures will be performed by research staff.

Data Management and Instrumentation

Once subjects have given full consent and signed paperwork, they will immediately be enrolled, and study procedures will be conducted. This will include:

1. Demographics and History

Subjects will complete a questionnaire that records age, sex, race, marital status, body mass index, rank, military occupation, and medical history. This includes current and previous significant diagnoses, surgeries, hospitalizations, and medications within the past six months.

2. Pain Measure

Subjects' pain levels will be quantified with the Defense and Veterans Pain Rating Scale (DVPRS). This instrument has undergone rigorous testing and has proven to be valid and reliable

in communicating pain and related outcomes, with a Chronbach's Alpha of 0.871 and test-retest reliability of $r=0.637$ to 0.774 (Polomano et al., 2016). For the purposes of this study, participants are asked to complete the DVPRS considering their average pain level over the previous three months. The DVPRS consists of a scale with pain options ranging from "0" (No Pain) to "10" (As bad as it could be, nothing else matters). The pain levels are grouped into three categories: 1-4="Mild/green", 5-6="Moderate/yellow", and 7-10="Severe/red". These three categories are for scoring and interpretation of results.

3. Sleep Status Measure

Sleep disruption status will be quantified using the Pittsburgh Sleep Quality Index (PSQI). In validity and reliability testing for primary insomnia, the PSQI demonstrated overall score test-retest reliability of 0.87, with high correlations between sleep log data (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002). A later study that examined validity and reliability of the PSQI in a non-clinical sample essentially replicated the findings, with high correlations with sleep diaries and depression scales, but lower with actigraphy (Grandner, Kripke, Yoon, & Youngstedt, 2006). The PSQI is effective at differentiating good and poor sleep through the measure of seven domains: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disturbances; use of sleep medication; and daytime dysfunction over the past month. Individual item scoring consists of "0-3" options with "3" being the negative extreme of the scale. A global score is calculated, which determines overall good or poor sleep. For the purposes of scoring and results interpretation, any score > 5 (range 0-21) demonstrates poor sleep quality, with higher values representing increasingly poorer sleep quality. The PSQI scoring calculations are as follows:

Scoring Component 1: Study Question (SQ) 9 total

Scoring Component 2: SQ2 + SQ5a (≤ 15 min=0, 16-30 min=1, 31-60 min=2, >60 min=3)

Scoring Component 3: SQ4 ($>7=0$, 6-6.9=1, 5-5.9=2, $<5=3$)

Scoring Component 4: SQ4/SQ3-SQ1 $\times 100$ ($>85\%=0$, 75-85%=1, 65-74.9%=2, and $<65\%=3$)

Scoring Component 5: SQ5b to SQ5j total (0=0, 1-9=1, 10-18=2, and 19-27=3)

Scoring Component 6: SQ6 total

Scoring Component 7: SQ7=SQ8 (0=0, 1-2=1, 3-4=2, and 5-6=3)

The Sum of all seven components represents the PSQI global score.

4. Work Performance Measure

Work performance will be measured using the “Individual Work Performance Questionnaire” (IWPQ). This self-report instrument has undergone reliability and validity testing, which demonstrated acceptable overall construct validity, sufficient convergent validity, and very good discriminative validity (Koopmans, Bernaards, Hildebrandt, Vet, & Van der Beek, 2014). The IWPQ is a validated 17-question instrument. Each question references the past three months and includes a single response option of “Never,” “Seldom,” “Sometimes,” “Regularly,” and “Often.” These responses are grouped into three domains that include “Task Performance,” “Contextual Performance,” and “Counterproductive work behavior” (CWB). A mean value, ranging between 0 and 4, is calculated for each domain, with a higher score reflecting better work performance. Internal consistency of the IWPQ was demonstrated with the following Cronbach’s alpha results: Task Performance = 0.78, Contextual Performance = 0.85, and CWB = 0.79. While the original IWPQ is in the Dutch language, it was cross-culturally adapted for American English. This adaptation process included a forward translation, synthesis, back

translation, an expert committee review, and pilot-testing. Cognitive interviews showed good comprehensibility, applicability, and completeness of the American-English IWPQ. (Cronbach's alphas of 0.79, 0.83, and 0.89 respectively, with good content validity).

Operational definitions for the three IWPQ domains are as follows: (1) Task Performance includes providing services, such as expertise in job related tasks, and activities that support technical and service aspects of a given job; (2) Contextual Performance includes activities that contribute to the social and psychological core of the organization. For example, the extra initiative and effort an individual is willing to provide in order to support the organization; and (3) Counterproductive Work Behavior are behaviors that go against the legitimate interests of an organization, which can be harmful to morale, productivity, culture, and even safety.

All participants are classified as either Blue Collar or White Collar based on their respective Military Occupation Specialty (MOS) or job title. The following table is used for results interpretation purposes:

Table 1

Blue Collar

	TP	CP	CWB
Very Low	≤ 2.00	≤ 1.25	≤ 0.20
Low	2.01 – 2.49	1.26 – 1.74	0.21 – 0.59
Average	2.50 – 3.16	1.75 – 2.99	0.60 – 1.39
High	3.17 – 3.49	3.00 – 3.24	1.40 – 1.79
Very High	≥ 3.50	≥ 3.25	≥ 1.80

Table 2

White Collar

	TP	CP	CWB
Very Low	≤ 1.83	≤ 1.37	≤ 0.40
Low	1.84 – 2.16	1.38 – 1.87	0.41 – 0.79
Average	2.17 – 2.99	1.88 – 2.87	0.80 – 1.59
High	3.00 – 3.32	2.88 – 3.24	1.60 – 1.99

Very High	≥ 3.33	≥ 3.25	≥ 2.00
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*Note: For both Blue and White Collar, lower TP and CP scores are associated with poorer work performance, while lower CWB scores are associated with better work performance.

Data Collection

The research staff will collect all data within the NMCSD Pain Medicine Clinic. Study data will include subjects' responses to the demographic and medical history questionnaire and the measurement instruments described above. Each subject will be assigned a unique study number and all data will be entered into an SPSS database for editing and analysis. No personally identifiable information (PII) will be included in the database. Source documentation will be housed in a locked file cabinet behind a locked door. Electronic data will be kept on a private, password-protected laptop.

Data Analysis Plan

Data analysis will be conducted using IBM SPSS Statistics v. 25.0 software.

1. Data will be summarized and examined to identify missing, illogical, and potential out-of-range (OOR) values. The original data sources will be referenced to correct the database.
2. Appropriate descriptive statistical (i.e., parametric or non-parametric) and graphical (e.g., box plots, histograms, etc.) methods will be used to characterize variables and variable distributions.
3. Two-way frequency tables, scatterplots, and pairwise correlations will be used to examine the associations between variables and the nature of the association of the primary independent variables with the outcome(s) (individual domain scores as well

as the global score). This will not only reveal highly correlated variables, but may also suggest the need for data transformation if analysis using multiple linear regression is an option.

Table 3

Describes the dependent variable, work performance. Table 4 describes the two independent variables, and Table 5 defines the seven demographic variables

Definition of Dependent Variable

Variable	Source	Level	Operational definition
Work Performance	IWPQ (Koopmans et al., 2014)	Ordinal	17 items each measured with a 5-point scale (0 = Never; 1 = Seldom; 2 = Sometimes; 3 = Regularly, and 4 = often). By averaging three subsets of responses, the average scores for three domains (task performance, contextual performance, and counterproductive work behavior) are generated. An overall/global score will be derived by averaging all 17 responses.

Note: ^b Task performance = “The proficiency with which individuals perform the core substantive or tasks central to his or her job”; ^c Contextual Performance = “Behaviors that support the organizational, social, and psychological environment in which the technical core must function”; ^d Counterproductive work behavior = “Behavior that harms the well-being of the organization” (Koopmans et al., 2014, p. 331).

Table 4

Definitions of Independent Variables

Variable	Source	Level	Operational definition
Pain status	DVPRS (Buckenmaier et al., 2016)	Continuous	One 10-point global scale ranging from 0 = No Pain to 10 = As bad as it could be.
Sleep disruption status	PSQI (Backhaus et al., 2002).	Continuous	19 items, with 7 seven component scores, measured using 4-point scales (0 = low to 3 = high). Summation of the component scores generates one global scale ranging from 0 to 21, where higher scores indicate greater levels of sleep

Table 5*Definitions of Demographic Variables*

Variable	Level	Operational definition
Age (years)	Continuous	Ordinal code: 1-99
Gender	Categorical	Nominal code: GEN = 0 if male; 1 = female
Rank	Categorical	Nominal code: RANK = 0 if enlisted; 1 = officer
Marital status	Categorical	Nominal code: MAR = 0 if not married; 1 = married
Military branch	Categorical	4 Dummy variables: AF = 1 if Air Force, otherwise 0 A = 1 if Army, otherwise 0 CG = 1 if Coast Guard, otherwise 0 MC = 1 if Marine Corp, otherwise 0 Navy = 0 0 0 0
Military Occupation	Categorical	Nominal: OCCUP = 0 blue collar, 1 = white collar
BMI (kg/m ²)	Continuous/ categorical	Depends upon data distribution, final sample size, and analytical method
Opioid use	Categorical	Nominal code: OP = 0 = No; 1 = Yes
Depression	Categorical	Nominal code: 0=No; 1 = Yes

Note: Source = Demographic questionnaire

The analysis will focus on each domain of work performance and the two primary independent variables, pain and sleep, adjusting for possible effect modification by the various demographic and medical history covariates available. There are many ways these associations

can be estimated, including modeling (e.g., multiple linear regression, logistic regression), analysis of variance (e.g., ANOVA, ANCOVA, MANOVA, MANCOVA), categorical (e.g., stratified chi-squared/ Mantel-Haenszel), and others. The appropriate method will ultimately depend upon the final sample size, the distribution and range of dependent and independent variables and covariates, the correlation structure of the data, and so on.

Whatever method is chosen, the goal will be to describe:

1. How pain is related to global work performance, and each of the three work performance domains.
2. How sleep is related to global work performance and each of the three work performance domains.
3. How pain and sleep interact in their relationship to global work performance and each of the three work performance domains.
4. Which, if any, of the demographic and medical history covariates modify the relationships described above, and the nature of the modification.

Post Data Collection Statistical Analysis Plan

Since the three dependent variables (task and conceptual performance, contextual performance, and counterproductive work behavior) are continuous, multiple linear regression will be used with up to 16 independent variables and covariates (the total number of variables and covariates in the study). In reality, it will most likely be less than 16 because one or more of the independent variables or covariates may not be correlated with the dependent variables or not meet test assumptions and will be removed from the final regression model.

CHAPTER IV

RESULTS

The purpose of this study was to examine the associations between chronic pain and sleep disruption in the context of work performance among active duty service members. In this chapter, study results are presented.

Data collection was completed in four weeks at the Naval Medical Center San Diego Pain Management Clinic. All participants were consented in private by research staff and allowed adequate time to read the consent and ask any questions. Additionally, research staff provided a verbal explanation of the consent and the study procedures and explanations. Informed Consent and HIPAA forms were signed and dated by all participants, as well as a researcher.

Once consented, participants were considered formally enrolled in the research study. All participants were then immediately given the study packet containing the demographics form, DVPRS scale, PSQI questionnaire, and the IWPQ questionnaire. A total of 145 participants consented, enrolled, and completed the study. All but three participants completed the study packets themselves. The remaining three participants chose to have each question of the study packet read to them by the researcher, who completed the questionnaires for them based on their verbal responses to each question. Once study packets were completed, the researcher reviewed all responses with the participant in order to verify answers and correct any unclear responses. The timeframe for completion of all study procedures, including consenting, averaged between 10-18 minutes. Due to the comprehensive and dedicated efforts of the researcher, and relatively low time and effort burden of the study procedures, the attrition rate was 0% with each participant completing all study responses resulting in no missing data.

Seven participants held positions as U.S. Naval Special Forces Operators. The research team decided to evaluate these seven participants as a separate group in order to uniquely classify their demographic characteristics and survey responses.

Descriptive Analysis

The following data address **Aim1**: To describe sociodemographic characteristics (age, gender, race, and marital status), military service characteristics (rank, branch, occupation, duty status, and special forces status), clinical characteristics (BMI, opioid use, pain status, and sleep status), and the work performance of active duty service members attending the Naval Medical Center San Diego (NMCSD) Pain Management Clinic.

Descriptive characteristics of all 145 study participants including the special forces group are presented in Table 1. Most of the sample were male (72.4%, $n = 105$); with 27.6% ($n = 40$) identifying as female, far exceeding the 14.4% overall average of females serving on active duty in the Armed Forces. About half of the sample were Caucasian (53.1%, $n = 77$), followed by Hispanic (23.4%, $n = 34$), African American (13.8%, $n = 20$), and Asian, Pacific Islander (9.7%, $n = 14$). Most were married (65.5%, $n = 95$). The great majority of the sample were “Enlisted” (E1-E9; 83.4%, $n = 121$), Navy (80.7%, $n = 117$), and were not Special Forces (95.2%, $n = 138$). Two-thirds of the sample (61.4%, $n = 89$) had full duty and about one-third (30.3%, $n = 44$) limited duty. Notably, 35.2% ($n = 51$) reported depression; a very high rate for this particular sample, considering prevalence of depression in the military is between 5.7% (never deployed) and 13.1% (currently deployed; Gadermann et al., 2012). Also of notice, 81.4% ($n = 118$) of the sample reported moderate or severe chronic pain; versus 44% of US service members who suffer from chronic pain after a combat deployment (Jonas & Schoomaker, 2014). Rates of opioid use in this sample are similar (9% ($n = 13$)) to those reported by Jonas & Schoomaker (2014) in post-

combat deployment service members. Participants' mean age was 34.84 ($SD = 8.55$), and had an average BMI of 27.6 ($SD = 4.02$). On average, participants worked 43.04 ($SD = 18.93$) hours per week; experienced a moderate amount of pain ($M = 5.99$, $SD = 1.50$); and had poor sleep quality ($M = 12.54$, $SD = 4.31$). For the overall sample, the average task performance was 2.14 ($SD = 1.04$), contextual performance 1.93 ($SD = 1.14$), and counterproductive work behavior 1.26 ($SD = 0.85$).

Special Forces (Table 1.1) participants were male, Navy, and full duty ($n = 7$). The majority were Caucasian (71.4%, $n = 5$), married (85.7%, $n = 6$), Enlisted (57.1%, $n = 4$), and blue collar workers. Depression (57.1%, $n = 4$) and opioid (100%, $n = 7$) use were very high among this group; depression and opioid use among other service members (not Special Forces) were considerably lower (34.1%, $n = 47$ and 9.4%, $n = 13$). Moderate and severe pain rates (85.5%, $n = 6$) were slightly higher than those of other service members (71.2%, $n = 112$). The average task performance for Special Forces participants was 2.57 ($SD = 0.34$), contextual performance 2.41 ($SD = 1.12$), and counterproductive work behavior 0.91 ($SD = 0.65$); These values represent better work performance in all domains than the non-Special Forces group (task performance $M = 2.12$, $SD = 1.04$; contextual performance, $M = 1.91$, $SD = 1.14$; and counterproductive work behavior, $M = 1.28$, $SD = 0.86$ respectively). Better work performance of the Special Forces group versus the non-Special Forces group, occurs even when the rates of depression, opioid use, and pain are higher in the Special Forces group.

Table 6

Sociodemographic, Military Service, and Clinical Characteristics of Study Population by Special Forces Status (N = 145)

	Total		Special Forces YES		Special Forces NO	
Characteristic	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender						
Female	40	27.6	0	0.0	40	29.0
Male	105	72.4	7	100.0	98	71.0
Race						
White	77	53.1	5	71.4	72	52.2
Hispanic, Latino	34	23.4	1	14.3	33	23.9
Black, African American	20	13.8	0	0.0	20	14.5
Asian, Pacific Islander	14	9.7	1	14.3	13	9.4
Marital Status						
Married	95	65.6	6	85.7	89	64.5
Single	26	17.9	0	0.0	26	18.8
Divorced	17	11.7	1	14.3	16	11.6
Separated	7	4.8	0	0.0	7	5.1
Military Rank						
Enlisted (E1-E9)	121	83.4	4	57.1	117	84.8
Warrant Officer (WO1-WO5)	4	2.8	1	14.3	3	2.2
Officer (O1-O8)	20	13.8	2	28.6	18	13.0
Military Branch						
Navy	117	80.7	7	100.0	110	79.7
Marines	25	17.2	0	0.0	25	18.1
Army	1	0.7	0	0.0	1	0.7

Air Force	1	0.7	0	0.0	1	0.7
Coast Guard	1	0.7	0	0.0	1	0.7
Military Occupation						
Blue collar	88	60.7	7	100.0	81	58.7
White collar	57	39.3	0	0.0	57	41.3
Special Forces						
Yes	7	4.8	--	--	--	--
No	138	95.2	--	--	--	--
	Total		Special Forces YES		Special Forces NO	
Characteristic	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Duty Status						
Full duty	89	61.4	7	100.0	82	59.4
Limited duty	44	30.3	0	0.0	44	31.9
Light duty	4	2.8	0	0.0	4	2.9
Other	8	5.5	0	0.0	8	5.8
Opioid Status						
Yes	13	9.0	7	100.0	13	9.4
No	132	91.0	0	0.0	125	90.6
Depression Status						
Yes	51	35.2	4	57.1	47	34.1
No	94	64.8	3	42.9	91	65.9
Pain Status (DVPRS)						
Mild (1-4)	27	18.6	1	14.3	26	18.8
Moderate (5-6)	60	41.4	3	42.9	57	41.3
Severe (7-10)	58	40.0	3	42.9	55	39.9

	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age, years	34.84	8.55	36.14	6.01	34.78	8.67
BMI, kg/m ²	27.60	4.02	29.10	3.72	27.52	4.03
Hours worked/week	43.04	18.93	44.29	14.25	42.98	19.17
Pain Score (DVPRS)	5.99	1.50	6.00	1.41	5.99	1.51
Sleep Score (PSQI)	12.54	4.31	12.00	4.62	12.57	4.31
Work Performance (IWPQ)						
Task performance	2.14	1.04	2.57	0.34	2.12	1.04
Contextual Performance	1.93	1.14	2.41	1.12	1.91	1.14
Counterproductive Work Behavior	1.26	0.85	0.91	0.65	1.28	0.86

Note. DVPRS = Defense & Veterans Pain Rating Scale; PSQI = The Pittsburgh Sleep Quality Index; IWPQ = Individual Work

Performance Questionnaire.

Figure 3

Figure 4

Figure 5 **Figure 6**

Figure 7

Bivariate Analysis

The following bivariate analyses address **Aim2**: To examine the relationships between sociodemographic characteristics (age, gender, race, marital status), military service characteristics (rank, branch, occupation, duty status, special forces status), clinical characteristics (BMI, opioid use, pain status, sleep status), and work performance of active duty service members attending the Naval Medical Center San Diego (NMCSD) Pain Management Clinic

Pearson's product-moment correlations were run to assess the relationship between (1) task performance, (2) contextual performance, and (3) counterproductive work behavior and: age, BMI, pain score, and sleep score (**Table 2**). Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity; hours worked per week violated test assumptions. Spearman's rho correlations were run to assess the relationship between (1) task performance, (2) contextual performance, and (3) counterproductive work

behavior and: hours worked per week. Results showed statistically significant associations between: Task performance and age ($r = .323, p < .001$, moderate), with age explaining 10% of the variation in task performance; task performance and pain score ($r = -.246, p = .003$, small), with pain explaining 6% of the variation in task performance; task performance and sleep score ($r = -.353, p < .001$, moderate), with sleep explaining 12% of the variation in task performance; contextual performance and age ($r = .392, p < .001$, moderate), with age explaining 15% of the variation in contextual performance; contextual performance and hours worked per week ($r = .200, p = .016$, small), with hours work per week explaining 4% of the variation in contextual performance; contextual performance and pain score ($r = -.271, p = .001$, small); with pain explaining 7% of the variation in contextual performance; contextual performance and sleep score ($r = -.368, p < .001$, moderate), with sleep explaining 13% of the variation in contextual performance; counterproductive work behavior and age ($r = -.192, p = .020$, small), with age explaining 4% of the variation in counterproductive work behavior; counterproductive work behavior and pain score ($r = .232, p = .005$, small) with pain explaining 5% of the variation in counterproductive work behavior; and counterproductive work behavior and sleep score ($r = .241, p = .004$, small), with sleep explaining 5% of the variation in counterproductive work behavior. As age increases, task and contextual performance increase, and counterproductive work behavior decrease. As sleep and pain get worse, task and contextual performance decrease, and counterproductive work behavior increase. A large positive association exists between pain and sleep scores ($r = .562, p < .001$); sleep explaining 32% of the variation in pain (or vice versa). All three work performance variables are significantly associated; with task and contextual performance being positively associated ($r = .731, p < .001$, large), and counterproductive work behavior being negatively associated with both task ($r = -.316, p < .001$, moderate) and contextual performance ($r = -.240, p = .004$, small).

Table 7

Sociodemographic, Military Service, and Clinical Characteristics of Study Population by Military Occupation (N = 145)

	Total		Blue Collar		White Collar	
Characteristic	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%

Gender						
Female	40	27.6	19	21.6	21	36.8
Male	105	72.4	69	78.4	36	63.2
Race						
White	77	53.1	45	51.1	32	56.1
Hispanic, Latino	34	23.4	22	25.0	12	21.1
Black, African American	20	13.8	14	15.9	6	10.5
Asian, Pacific Islander	14	9.7	7	8.0	7	12.3
Marital Status						
Married	95	65.6	60	68.2	35	61.4
Single	26	17.9	16	18.2	10	17.5
Divorced	17	11.7	8	9.1	9	15.8
Separated	7	4.8	4	4.5	3	5.3
Military Rank						
Enlisted (E1-E9)	121	83.4	81	92.0	40	70.2
Warrant Officer (WO1-WO5)	4	2.8	3	3.4	1	1.8
Officer (O1-O8)	20	13.8	4	4.5	16	28.1
Military Branch						
Navy	117	80.7	71	80.7	46	80.7
Marines	25	17.2	15	17.0	10	17.5
Army	1	0.7	1	1.1	0	0.0
Air Force	1	0.7	0	0.0	1	1.8
Coast Guard	1	0.7	1	1.1	0	0.0
Military Occupation						
Blue collar	88	60.7	--	--	--	--

White collar	57	39.3	--	--	--	--
Special Forces						
Yes	138	95.2	7	8.0	0	0.0
No	7	4.8	81	92.0	57	100.0
	Total		Blue Collar		White Collar	
Characteristic	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Duty Status						
Full duty	89	61.4	47	53.4	42	73.7
Limited duty	44	30.3	33	37.5	11	19.3
Light duty	4	2.8	2	2.3	2	3.5
Other	8	5.5	6	6.8	2	3.5
Opioid Status						
Yes	13	9.0	8	9.1	5	8.8
No	132	91.0	80	90.9	52	91.2
Depression Status						
Yes	51	35.2	37	42.0	14	24.6
No	94	64.8	51	58.0	43	75.4
Pain Status (DVPRS)						
Mild (1-4)	27	18.6	16	18.2	11	19.3
Moderate (5-6)	60	41.4	37	42.0	23	40.4
Severe (7-10)	58	40.0	35	39.8	23	40.4
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age, years	34.84	8.55	33.35	8.38	37.14	8.37
BMI, kg/m ²	27.60	4.02	27.78	4.19	27.31	3.75
Hours worked/week	43.04	18.93	41.86	18.86	44.86	19.05

Pain Score (DVPRS)	5.99	1.50	5.99	1.54	5.98	1.46
Sleep Score (PSQI)	12.54	4.31	13.11	4.23	11.67	4.38
Work Performance (IWPQ)						
Task performance	2.14	1.04	2.09	1.01	2.21	1.08
Contextual Performance	1.93	1.14	1.83	1.13	2.09	1.15
Counterproductive Work Behavior	1.26	0.85	1.23	0.83	1.32	0.89

Note. DVPRS = Defense & Veterans Pain Rating Scale; PSQI = The Pittsburgh Sleep Quality Index; IWPQ = Individual Work Performance Questionnaire.

A One-way ANOVA was conducted to determine if participants' gender, race, marital status, military rank, branch, occupation, duty status, Special Forces status, opioid use, and pain status were significantly different in terms of task performance, contextual performance, and counterproductive work behavior. Patients' gender was classified into (male, female), race (African American, Caucasian, Latino, Asian/Pacific Islander, Other), marital status (single, married, separated, divorced, widowed), military rank (Enlisted, Warrant Officer, Officer), branch (Navy, Marine Corps, Army/Air Force/Coast Guard), occupation (blue collar, white collar), duty status (full, limited, light, other), special forces status (yes, no), opioid use (yes, no), and pain status (mild, moderate, severe). Homogeneity of variances was assessed by Levene's test of homogeneity of variances; Welch robust test for equality of means are reported for those ANOVA results that do not meet the homogeneity of variance assumption.

Task Performance & Duty Status

Significant differences exist between task performance and duty status, $F(3, 141) = 4.32$, $p = .006$, $\eta^2 = .084$ moderate effect. When compared with those on full duty ($M = 2.37$, $SD =$

0.94), task performance for those on limited duty was significantly lower ($M = 1.77$, $SD = 1.07$).

Tuckey post-hoc analysis revealed that the decrease in task performance from those in the full duty to limited duty group (0.60, 95% CI [0.12 to 1.08], $p = .008$) was statistically significant.

Figure 8

Task Performance & Depression

Significant differences exist between task performance and depression status, $F(1, 143) = 10.39$, $p = .002$, $\eta^2 = .068$, moderate effect. When compared with those non-depressed ($M = 2.34$, $SD = 1.01$), task performance for those depressed was significantly lower ($M = 1.78$, $SD = 0.99$).

Figure 9

Task Performance & Pain

Significant differences exist between task performance and pain status, $F(2, 142) = 7.07$, $p = .001$, $\eta^2 = .091$ large effect. When compared to those with mild pain ($M = 2.40$, $SD = 1.06$), task performance for those with severe pain ($M = 1.76$, $SD = 0.89$) was significantly lower. When compared with those with moderate pain ($M = 2.39$, $SD = 1.07$), task performance for those with severe pain was also significantly lower ($M = 1.76$, $SD = 0.89$). Tuckey post-hoc analysis revealed that the decrease in task performance from those in the moderate to severe pain groups (0.63, 95% CI [0.20 to 1.07], $p = .002$) and from those in the mild to severe pain groups (0.64, 95% CI [0.09 to 1.19], $p = .018$) were statistically significant.

Figure 10

Contextual Performance & Military Rank

Significant differences exist between contextual performance and military rank, $F(2, 142) = 3.83$, $p = .024$, $\eta^2 = .051$ small effect. When compared with Enlisted participants ($M = 2.11$, $SD = 1.02$), contextual performance for warrant officers ($M = 3.10$, $SD = 0.84$) was significantly higher. Tuckey post-hoc analysis revealed that the increased in contextual performance from

Enlisted to Warrant Officer (1.52, 95% CI [0.17 to 2.87], $p = .023$) was statistically significant.

Figure 11

Contextual Performance & Duty Status

Significant differences exist between contextual performance and duty status, Welch ANOVA (3, 13) = 6.04, $p = .009$, $\eta^2 = .100$ moderate effect. When compared with those on full duty ($M = 2.22$, $SD = 1.00$), contextual performance for those on limited duty ($M = 1.49$, $SD = 1.20$) was significantly lower. Games-Howell post-hoc analysis revealed that the decrease in contextual performance from those in the full duty to limited duty groups (0.73, 95% CI [0.18 to 1.28], $p = .005$).

Figure 12

Contextual Performance & Depression

Significant differences exist between contextual performance and duty status, $F(1, 143) = 11.25, p = .001, \eta^2 = .073$ moderate effect. When compared with no-depression ($M = 2.16, SD = 1.11$), contextual performance for those depressed ($M = 1.52, SD = 0.09$) was significantly lower.

Figure 13

Contextual Performance & Pain

Significant differences exist between contextual performance pain level, $F(2, 142) = 7.90, p = .001, \eta^2 = .100$ moderate effect. Patients with severe pain ($M = 1.49, SD = 1.10$) had lower contextual performance than those with moderate ($M = 2.24, SD = 1.12$) and mild ($M =$

2.19, $SD = 1.00$) pain levels. Tuckey post-hoc analysis revealed that the decrease in contextual performance from severe to both moderate (0.75, 95% CI [0.27 to 1.23], $p = .001$) and mild (1.52, 95% CI [0.17 to 2.87], $p = .023$) were statistically significant.

Figure 14

Counterproductive Work Behavior & Depression

Significant differences exist between counterproductive work behavior and depression, $F(1, 143) = 9.20$, $p = .003$, $\eta^2 = .060$ moderate effect. When compared with no-depression ($M = 1.11$, $SD = 0.81$), counterproductive work behavior performance for those depressed ($M = 1.55$, $SD = 0.86$) was significantly higher.

Figure 15

Counterproductive Work Behavior & Pain

Significant differences exist between counterproductive work behavior and pain level, Welch ANOVA (2, 81) = 6.19, $p = .003$, $\eta^2 = .056$ small effect. Patients with severe pain ($M = 1.43$, $SD = 0.92$) had lower counterproductive work behavior than those with moderate ($M = 1.28$, $SD = 0.83$) and mild ($M = 2.40$, $SD = 1.06$) pain levels. Games-Howell post-hoc analysis revealed that the increase in counterproductive work behavior from mild to both moderate (0.41, 95% CI [0.32 to 0.79], $p = .030$) and severe (0.56, 95% CI [0.16 to 0.96], $p = .003$) were statistically significant.

Figure 16

Neither task performance, contextual performance, nor counterproductive work behavior are significantly different in terms of gender, race, marital status, military occupation, special forces, or opioid status.

Regression Analysis

The following regression analyses address **Aim3**: To determine what sociodemographic characteristics (age, gender, race, marital status), military service characteristics (rank, branch, occupation, duty status, special forces status), and clinical characteristics (BMI, opioid use, pain status, sleep status), increase task performance and contextual performance, and decrease counterproductive work behavior of active duty service members attending the Naval Medical Center San Diego (NMCSD) Pain Clinic.

A linear regression was run to understand the effect of age, military occupation, duty status, depression, pain, and sleep on task performance. To assess linearity, scatter plots of age, pain, and sleep against task performance, with regression line and 95% CI, were plotted. Visual inspection of these plots indicated a linear relationship between the variables. There was homoscedasticity, normality of residuals, and no-outliers. A linear regression established that age, depression, and sleep significantly predict task performance scores, $F(8, 136) = 5.881, p < .001$; with these predictors accounting for 25.7% of the variation in task performance scores with adjusted $R^2 = 21.3\%$ of the explained variability in task performance scores; a large effect size according to Cohen (1988). One more year of age leads to a slight increase in task performance score ($B = 0.036$, 95% CI 0.02, 0.06). Depression ($B = -.355$, 95% CI -.703, -.007) and sleep dysfunction ($B = -.059$, 95% CI -.104, -.014) decrease task performance.

Table 8

Regression Analysis Summary for Sociodemographic, Military Service, and Clinical Characteristics Predicting Task Performance (N = 145)

Variable	B	95% CI for B		β	t	p
		LL	UL			
Age, years	0.04	0.02	0.06	0.30	3.69	< .001
Military Occupation, blue collar ^a	-0.22	-0.55	0.11	-0.10	-1.29	.198
Duty Status, limited duty	-0.19	-0.57	0.19	-0.09	-1.01	.316
Duty Status, light duty	-0.05	-1.01	0.91	-0.01	-0.11	.913
Duty Status, other duty	-0.49	-1.19	0.20	-0.11	-1.41	.160
Depression Status, yes ^b	-0.36	-0.70	0.01	-0.16	-2.02	.045
Pain Score (DVPRS)	-0.01	-0.14	0.12	-0.01	-0.13	.895
Sleep Score (PSQI)	-0.06	-0.10	-0.01	-0.25	-2.59	.011

Note. B = unstandardized regression coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; β = standardized coefficient. ^a White collar is the reference category; ^b No is the reference category

Figure 17

Figure 18

Figure 19

Figure 20

A linear regression was run to understand the effect of age, military rank, military occupation, duty status, hours worked per week, depression, pain, and sleep on contextual performance. To assess linearity, scatter plots of age, hours worked per week, pain and sleep against contextual performance, with regression line and 95% CI, were plotted. Visual inspection of these plots indicated a linear relationship between the variables. There was homoscedasticity, normality of residuals and no-outliers. A linear regression established that age, depression, and sleep significantly predict contextual performance scores, $F(11, 133) = 6.491$, $p < .001$; with these predictors accounting for 34.9% of the variation in contextual performance scores with adjusted $R^2 = 29.5\%$ of the explained variability in contextual performance scores; a large effect size according to Cohen (1988). One more year of age leads to a slight increase in contextual performance score ($B = 0.042$, 95% CI 0.02, 0.06). Depression ($B = -.373$, 95% CI $-.738, -.008$) and sleep dysfunction ($B = -.068$, 95% CI $-.115, -.021$) decrease contextual performance.

Table 9

Regression Analysis Summary for Sociodemographic, Military Service, and Clinical Characteristics Predicting Contextual Performance (N = 145)

Variable	<i>B</i>	95% CI for <i>B</i>		β	<i>t</i>	<i>p</i>
		LL	UL			
Age, years	0.04	0.02	0.06	0.31	4.01	< .001
Military Rank, warrant officer ^a	0.98	-0.02	1.99	0.14	1.94	.054
Military Rank, officer	-0.22	-0.72	0.28	-0.07	-0.87	.387
Military Occupation, blue collar ^b	-0.05	-0.41	0.31	-0.02	-0.27	.787
Duty Status, limited duty	-0.16	-0.56	0.24	-0.07	-0.81	.421
Duty Status, light duty	-0.51	-1.54	0.52	-0.07	-0.97	.332
Duty Status, other duty	-0.23	-0.96	0.50	-0.05	-0.62	.535
Hours worked per week	0.01	0.00	0.02	0.14	1.92	.057
Depression Status, yes ^c	-0.37	-0.74	-0.01	-0.16	-2.02	.045
Pain Score (DVPRS)	-0.03	-0.17	0.12	-0.04	-0.47	.641
Sleep Score (PSQI)	-0.07	-0.12	-0.02	-0.26	-2.84	.005

Note. *B* = unstandardized regression coefficient; *CI* = confidence interval; *LL* = lower limit; *UL* = upper limit; β = standardized

coefficient. ^a Enlisted is the reference category; ^b White collar is the reference category; ^c No is the reference category.

Figure 21

Figure 22

Figure 23

Figure 24

Figure 25

A linear regression was run to understand the effect of age, military occupation, depression, pain, and sleep on counterproductive work behavior. To assess linearity, scatter plots of age, pain and sleep against counterproductive work behavior, with regression line and 95% CI, were plotted. Visual inspection of these plots indicated a linear relationship between the variables. There was homoscedasticity, normality of residuals and no-outliers. A linear regression established that age and depression significantly predict conceptual performance scores, $F(5, 139) = 4.909, p < .001$; with these predictors accounting for 15% of the variation in conceptual performance scores with adjusted $R^2 = 12\%$ of the explained variability in counterproductive work behavior; a moderate effect size according to Cohen (1988). One more year of age leads to a slight decrease in counterproductive work behavior ($B = -0.021$, 95% CI - 0.04, -0.01). Depression ($B = .354$, 95% CI .052, .655) increases counterproductive work behavior.

Table 10

*Regression Analysis Summary for Sociodemographic, Military Service, and Clinical Characteristics
Predicting Counterproductive Work Behavior (N = 145)*

Variable	<i>B</i>	95% CI for <i>B</i>		β	<i>t</i>	<i>p</i>
		LL	UL			
Age, years	-0.02	-0.04	-0.01	-0.21	-2.67	.009
Military Occupation, blue collar ^b	0.27	-0.02	0.55	0.14	1.85	.066
Depression Status, yes ^c	0.35	0.05	0.66	0.15	2.32	.022
Pain Score (DVPRS)	0.06	-0.05	0.17	0.05	1.05	.295
Sleep Score (PSQI)	0.02	-0.02	0.06	0.02	1.20	.232

Note. *B* = unstandardized regression coefficient; *CI* = confidence interval; *LL* = lower limit; *UL* = upper limit; β = standardized

coefficient. ^a Enlisted is the reference category; ^b White collar is the reference category; ^c No is the reference category.

Figure 26

Figure 27

Figure 28

Figure 29

Conclusion

A prospective cross-sectional descriptive design was used for this study. Participants were currently serving on active duty in the military, and had a chronic pain diagnosis. All participants were empaneled to the Pain Management Clinic at a large military treatment facility in Southern California. All data were collected prospectively through participants' self-report. No medical records were accessed for this study. Self-report data were collected through written documentation. This documentation included a (1) demographic page, which collected age, gender, marital status, branch of service, rank, race, BMI, occupation, hours worked per week, opioid use status, duty status, and depression status; and (2) DVPRS to collect pain status over the previous three month period; (3) PSQI to assess sleep status using the instrument's global score; and (4) the IWPQ to assess work performance by utilizing the scores of the instrument's three domains of Task Performance, Contextual Performance, and Counterproductive Work Behavior.

Aim 1 was analyzed using descriptive statistics to describe patterns within the data. Means and standard deviations were reported for continuous data and percentages and frequencies for categorical data. Aim 2 was analyzed using Pearson's product-moment correlations to assess relationships between dependent variables and select independent variables, and one-way ANOVA was used to examine relationships between other select demographic data, clinical data, and dependent variables. Aim 3 was analyzed by using a multiple linear regression model to understand effects of select demographic and clinical variables on work performance, as well as demographic variables on clinical variables including pain, sleep and work performance.

Data for all aims demonstrated statistical significance. Future research with larger, more diverse, and more robust patient populations is recommended to further examine statistical significance in greater depth.

Chapter V

Discussion of Findings

The purpose of this study was to examine the associations between chronic pain and sleep disruption in the context of work performance among active duty service members. In this chapter, discussion of research findings, study limitations, and recommendations for future research and clinical practice are presented.

Engel's (1977) Biopsychosocial model provided the theoretical framework for this study. This model addresses the link among socioeconomic, psychology, and biological factors. The model is widely used and accepted in pain research. This study included and examined all aspects of the model by exploring socioeconomic demographic characteristics, depression status to address psychology, and chronic pain conditions that include diagnoses, as well as sleep behaviors to address biology.

Data was prospectively collected on 145 participants during the month of June 2020 at a large U.S. Naval hospital in Southern California. Active duty military patients between the ages of 18-65, and enrolled in the Pain Management Clinic were included in the study.

The sample for this study included a variety of characteristics. The number of female participants was 27.6%, which greatly exceeds the number of total active duty women in the military average of 14.4% ("Military Demographics," 2019). Additionally, the vast majority of female participants were active duty Navy, which also exceeds the 19% average of women serving in the Navy (Dever, 2019). However, this finding is less than the 75% of female veterans that report having chronic pain (Rhodes, 2017). Age, race, and marital status were consistent with total military averages. Additionally, rank makeup within the study were consistent with expectations, with enlisted ranks accounting for 83.4% of study participants. Study participants

were classified as blue or white collar primarily for the purposes of allowing for greater depth in examining work performance, with 60.7% classified as blue collar workers. While no literature could be found that discusses these classifications among military, the numbers are consistent with a variety of civilian articles that report blue collar Americans ranging from 55% to 80%.

Not surprisingly, all participants reported the presence of pain. While the average number of participants reported moderate pain (41.4%), severe cases were very similar, with 40% reporting severe pain in the preceding three months. Additionally, 35.2% of these participants reported depression, which is a far greater depression rate than the general military population. Depressed participants demonstrated a significantly higher pain level versus those without depression. The study design does not allow for evaluating these variables for a reciprocal relationship, but published research indicates the presence of one having a mutual corresponding impact on the other.

Recommendations for Clinical Practice and Future Research

This study revealed both statistical and clinical significance among all three dependent variables. An incidental finding included seven Naval special forces participants. Descriptive analysis demonstrated that this group, while experiencing poor sleep and higher levels of moderate to severe pain, had far better work performance, in all three domains, than the rest of the study participants. Additionally, and counter to the non-Special Forces participants, this group was able to demonstrate high levels of work performance despite a higher prevalence of depression and opioid use compared to the other participants. Due to such a small sample, no other statistically significant findings could be attributed to this group. However, these findings could suggest specific traits or circumstances among this cohort that allow higher levels of work performance despite the presence of pain and sleep disruption.

Analysis demonstrated statistically significant relationships in all three work performance domains. Hours worked per week were found to be a small predictor of Contextual Performance. This suggests that Contextual Performance is only slightly improved with more hours worked per week. Clinically speaking, this indicator, while small, may suggest the involvement of additional factors that explain this finding, such as job type, age, rank, and support from leadership. Future research can further explore such as management, leadership, and chain of command assessments.

Furthermore, when examining Task Performance, duty status was a strong predictor of performance. Participants on full duty had a much better Task Performance score than those on limited duty. This finding could suggest clinical significance, especially within the mental health realm, as these participants also had higher depression levels.

Depression status was a strong indicator of work performance in all three domains. Participants with depression had far worse work performance scores than those without depression. Additional research to examine these relationships could lead to better understanding, and potential treatment strategies that target depression, and its impact on work performance within the military.

Age was demonstrated as a significant predictor of work performance in the Task Performance and Contextual Performance domains. These data suggest that performance within these two domains improves as age increases. These findings could hold particular clinical significance in examining characteristics of older patients with pain and how they successfully navigate the work environment.

Pain and sleep were strong predictors of work performance in all three domains. While studies have shown strong reciprocal relationships between pain and sleep, this study suggests a

similar relationship between these two variables and work performance. Overall, work performance was better among study participants who experienced less pain and less sleep disruption.

Limitations

Limitations of this study include key methodology factors. This study was conducted at a single U.S. Navy hospital, which primarily serves Navy and Marine Corps personnel within the region. This resulted in an under-representation of the remaining three Armed Forces branches (Army, Air Force, and Coast Guard). A chronic pain diagnosis was a requirement for this study. Including work performance data from participants that do not suffer from chronic pain could provide additional understanding within the work performance and pain landscape.

All data collected for this study derived from self-report methods. Accessing medical records could potentially be more effective at capturing diagnoses, treatment, and even demographic data. Additionally, including actigraphy to evaluate sleep could provide a more robust and accurate representation than a self-report instrument alone. In terms of work performance, additional instrumentation that included supervisory or managerial input could provide greater context and an increased understanding of these relationships.

Summary

Effectively managing and navigating the challenges of chronic pain and its effects on mission readiness and deployment is a priority for the U.S. Military. Understanding the nature of relationships between chronic pain, sleep, and a service member's work performance is critical to addressing and meeting military challenges, especially in potential theaters of war. Establishing a foundation for understanding these constructs can lead to future interventional studies, policy modifications, and cultural adaptations that will improve prevention, diagnosis,

and treatment of chronic pain, and thus improve individual and unit military readiness. Tackling this critical issue comprehensively and thoughtfully will allow leaders to productively face the challenging missions of today's military, while ensuring our warfighters receive the respect, dignity, and care they deserve.

In summary, this study addressed the crucial issue of how the ever-growing chronic pain dilemma impacts mission readiness within the military. By examining relationships and effects of pain, sleep, demographic factors, and work performance, the study represents a first step in the understanding of this unique problem, and those affected.

Conclusion

The potential impact of pain and sleep disruption on work performance among military service members can be immense. Recognizing the possible negative outcomes associated with these factors is critical to addressing the unique needs of this patient population. Furthermore, understanding the competing priorities of occupational expectations and treatment plans for these individuals is important for unit leaders and health care providers. This mutual awareness will allow them to successfully navigate the complexities of ensuring every active service member is fit and ready to face the global challenges of today's military.

References

- Backhaus, J., Junghanns, K., Broocks, A., Riemann, D., & Hohagen, F. (2002, September). Test-retest reliability and validity of the pittsburgh sleep quality index in primary insomnia. *Journal of Psychosomatic Research*, 53(3), 737-740.
[https://doi.org/https://doi.org/10.1016/S0022-3999\(02\)00330-6](https://doi.org/https://doi.org/10.1016/S0022-3999(02)00330-6)
- Bader, C. E., Giordano, N. A., McDonald, C. C., Meghani, S. H., & Polomano, R. C. (2018). Musculoskeletal pain and headache in the active duty military population: An integrative review. *Worldview on Evidence-Based Nursing*, 15(4), 264-271.
- Blanca, M.J., Alarcón, R., Arnau, J., Bono, R., & Bendayan, R. (2017). Non-normal data: Is ANOVA still a valid option? *Psicothema*, 29(4), 552-557.
[doi:10.7334/psicothema2016.383](https://doi.org/10.7334/psicothema2016.383)
- Buckenmaier III, C., Galloway, K. T., Polomano, R. C., & Deuster, P. A. (2016, Summer). Pain as a barrier to human performance: A focus on function for self-reporting pain with the defense veterans pain rating scale. *Journal of Special Operations Medicine*, 16(2), 82-87
- Buyse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1988, November 12). The pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28, 193-213.
- Carifio, J. & Perla, R. (2008). Resolving the 50-year debate around using and misusing Likert scales. *Medical Education*, 42, 1150-1152.
- Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). New York: Psychology Press.
- Convergent validity and discriminant validity: Definition, examples. (2020). Retrieved from [statisticshowto.com](https://www.statisticshowto.com)

- Dever, M. (2019, March 11). With historic number of women in uniform, the vet community is about to change. *Military.com*. Retrieved from <https://www.military.com/daily-news/2019/03/11/historic-number-women-uniform-vet-community-about-change.html>
- Edwards, R. R., Almeida, D. M., Klick, B., Haythornwaite, J. A., & Smith, M. T. (2008, July). Duration of sleep contributes to next-day pain report in the general population. *Pain*, 137(1), 202-207. <https://doi.org/10.1016/j.pain.2008.01.025>
- Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science*, 196(), 129-136.
- Engel, G. L. (1980, May). The clinical application of the biopsychosocial model. *American Journal of Psychiatry*, 137(5), 535-544. <https://doi.org/10.1176/ajp.137.5.535>
- Ferguson, C.F. (2009). An effect size primer: a guide for clinicians and researchers. *Professional Psychology: Research and Practice*, 40, 532-538.
- Field, A.P. (2013). *Discovering statistics using IBM SPSS. (4th ed.)*. Thousand Oaks, CA: Sage.
- Fighting pain in the U.S. military and veterans. (2017). Retrieved from <https://nccih.nih.gov/news/multimedia/VA-DoD-nondrug-pain-research>
- Gadernann AM, Engel CC, Naifeh JA et al: Prevalence of DSM-IV major depression among U.S. military personnel: meta-analysis and simulation. *Mil Med* 2012; 177(8 Suppl): 47–59.
- Gatchel, R. J., & Howard, K. J. (2018, April 12). The biopsychosocial approach. *Practical Pain Management*, 8. Retrieved from <https://www.practicalpainmanagement.com/treatments/psychological/biopsychosocial-approach>

- Gastworth, J.L., Gel, Y.R., & Miao, W. (2005). The impact of Levene's test of equality of variance on statistical theory and practice. *Statistical Science*, 24, 343-360.
- Generaal, E., Vogelzangs, N., Penninx, B. W., & Dekker, J. (2017). Insomnia, sleep duration, depressive symptoms, and the onset of chronic multisite musculoskeletal pain. *Sleep*, 40(1), 1-10. <https://doi.org/10.1093/sleep/zsw030>
- Glass, G.V., P.D. Peckham, and J.R. Sanders. (1972). Consequences of failure to meet assumptions underlying fixed effects analyses of variance and covariance. *Rev. Educ. Res.* 42: 237-288.
- Grandner, M. A., Kripke, D. F., Yoon, I., & Youngstedt, S. D. (2006, June). Criterion validity of the pittsburgh sleep quality index: investigation in a non-clinical sample. *Sleep and Biological Rhythms*, 4(2), 129-139. <https://doi.org/https://dx.doi.org/10.1111%2Fj.1479-8425.2006.00207.x>
- Hair, J., Anderson, R. E., Babin, B. J., Tatman, R. L., & Black, W. C. (2010). *Multivariate data analysis*. Upper Saddle River, NJ: Prentice Hall.
- Harwell, M.R., E.N. Rubinstein, W.S. Hayes, and C.C. Olds. (1992). Summarizing Monte Carlo results in methodological research: the one- and two-factor fixed effects ANOVA cases. *J. Educ. Stat.* 17: 315-339.
- Jonas, W. B., & Schoomaker, E. B. (2014). Pain and opioids in the military; we must do better. *JAMA Internal Medicine*, 174(8), 1402-1403.
- Jungquist, C. R., O'Brien, C., Matteson-Rusby, S., Smith, M. T., Pigeon, W. R., Xia, Y., ... Perlis, M. R. (2010, March). The efficacy of cognitive behavioral therapy for insomnia in patients with chronic pain. *Sleep Medicine*, 11(3), 1-19. <https://doi.org/10.1016/j.sleep.2009.05.018>

- Kessler, R. C., Berglund, P. A., Coulouvrat, C., Hajak, G., Roth, T., Shahly, V., ... Walsh, J. K. (2011, May). Insomnia and the performance of US workers: Results from the America insomnia survey. *Sleep*, 34(9), 1161-1171. <https://doi.org/10.5665/SLEEP.1230>
- Knutson, K. L., Rathouz, P. J., Yan, L. L., Liu, K., & Lauderdale, D. S. (2006). Stability of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Questionnaires over 1 year in early middle-aged adults: The CARDIA study. *Sleep*, 29(11), 1503-1506.
- Koopmans, L., Bernaards, C. M., Hildebrandt, V. H., Vet, H. C., & Van der Beek, A. J. (2014). Construct validity of the individual work performance questionnaire. *Journal of Occupational and Environmental Medicine*, 56(3), 331-337. <https://doi.org/10.1097/JOM.000000000000113>
- Lamb, S., & Kwok, K. C. (2016, January). A longitudinal investigation of work environment stressors on the performance and wellbeing of office workers. *Applied Ergonomics*, 52, 104-111. <https://doi.org/doi:10.1016/j.apergo.2015.07.010>
- Lix, L. M., Keselman, J. C., & Keselman, H. J. (1996). Consequences of assumption violations revisited: A quantitative review of alternatives to the one-way analysis of variance F test. *Review of Educational Research*, 66, 579-619.
- Maucione, S. (2018). DOD starts crackdown on more than 280,000 non-deployable troops. Retrieved from <https://federalnewsnetwork.com/defense/2018/02/dod-starts-crackdown-on-more-than-280000-nondeployable-troops-requires-services-to-start-removing-them-by-october/>
- Maxwell, S. E., & Delaney, H. D. (2004). *Designing experiments and analyzing data: A model comparison perspective* (2nd ed.). New York: Psychology Press.

- Mollayeva, T., Thurairajah, P., Burton, K., Mollayeva, S., Shapiro, C. M., & Colantonio, A. (2015, February 17). The pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta analysis. *Sleep Medicine Reviews*, 25(2016), 52-73. <https://doi.org/>
- Polomano, R. C., Galloway, K. T., Kent, M. L., Brandon-Edwards, H., Kwon, K. N., Morales, C., & Buckenmaier, C. (2016, August). Psychometric testing of the defense and veterans pain rating scale (DVPRS): a new pain scale for military population. *Pain Medicine*, 17(8), 1505-1519. <https://doi.org/10.1093/pm/pnw105>
- Osborne, J.W., & Waters, E. (2002). Four assumptions of multiple regression that researchers should always test. *Practical Assessment, Research & Evaluation*, 8, 1-7.
- Rawlings, J.O., Pantula, S.G., & Dickey, D.A. (2013). *Applied regression analysis: a research tool*. New York, NY: Springer.
- Rener-Sitar, K., John, M. T., Bandyopadhyay, D., Howell, M. J., & Schiffman, E. L. (2014, January 21). Exploration of dimensionality and psychometric properties of the Pittsburgh Sleep Quality Index in cases with temporomandibular disorders. *Health Qual Life Outcomes*, 12(10). <https://doi.org/10.1186/1477-7525-12-10>
- Rhodes, C. (2017, October 16). Addressing chronic pain in the United States armed forces. *Practical Pain Management*, 17. Retrieved from <https://www.practicalpainmanagement.com/treatments/addressing-chronic-pain-united-states-armed-forces>
- Rodrigues, I. B., Adachi, J. D., Beattie, K. A., Lau, A., & MacDermid, J. C. (2019, August 14). Determining known-group validity and test-retest reliability in the PEQ (personalized

- exercise questionnaire). *BMC Musculoskelet Disord*, 20(1), 373.
<https://doi.org/10.1186/s12891-019-2761-3>
- Rutherford, A. (2011). *ANOVA and ANCOVA: A GLM approach* (2nd ed.). Hoboken, NJ: John Wiley & Sons.
- Sagherian, K., Clinton, M. E., Huijjer, H. A., & Geiger-Brown, J. (2017, July). Fatigue, work schedules, and perceived performance in bedside care nurses. *Workplace Health & Safety*, 65(7), 304-312. <https://doi.org/doi: 10.1177/2165079916665398>
- Sawilowsky, S. S., & Blair, R. C. (1992). A more realistic look at the robustness and Type II error properties of the t test to departures from population normality. *Psychological Bulletin*, 111, 352-360.
- Schmieder, E., Ziegler, M., Danay, E., Beyer, L., & Bühner, M. (2010). Is it really robust? Reinvestigating the robustness of ANOVA against violations of the normal distribution assumption. *European Journal of Research Methods for the Behavioral and Social Sciences*, 6, 147-151.
- Shattuck, N. L., & Brown, S. A. (2013, February 1). Wounded in action: what the sleep community can learn from sleep disorders of US military service members. *Sleep*, 36(2), 159-160.
- Smyth, C. A. (2008). Evaluating Sleep Quality in Older Adults: The Pittsburgh Sleep Quality Index can be used to detect sleep disturbances or deficits. *American Journal of Nursing*, 108(5) 42 – 50.
- Tabachnick, B.G., & Fidell, L.S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Allyn & Bacon.

- Tang, N. K. (2008, September). Insomnia co-occurring with chronic pain: Clinical features, interaction, assessments and possible interventions. *Reviews in Pain*, 2(1), 1-7.
- U.S. military demographics. (2019). Retrieved from americaspromise.org
- Wei, Y., Blanken, T. F., & Van Someren, E. J. (2018, August). Insomnia really hurts: Effect of a bad night's sleep on pain increases with insomnia severity. *Frontiers in Psychiatry*, 9(377), 1-8. <https://doi.org/10.3389/fpsy.2018.00377>

Appendix A

Demographic Information Form

Instructions: Please provide a response for each of the following questions:

1. Age? _____

2. Sex? Female ☐ Male ☐

If female, currently pregnant? Yes ☐ No ☐

3. Marital status?

Single ☐

Married ☐

Separated ☐

Divorced ☐

Widowed ☐

4. Branch of Service? _____ **5. What is your rank/grade?** _____

6. With which racial or ethnic category do you identify?

African American ☐

Asian/Pacific Islander ☐

Caucasian ☐

Latino ☐

Other: _____

7. Height in inches? _____

8. Weight? _____

9. Please list any medications you are currently taking (only if consistently taking for at least three months)

10. Please list any current chronic medical conditions/diagnoses

11. What is your MOS/Job Title? _____

12. What is the average number of hours you worked per week over the past month?

13. Length of current diagnosis requiring Pain Management treatment (in months)? _____

14. Current Duty Status?

Full Duty ☐

Limited Duty ☐

Light Duty ☐

Other ☐

15. Do you currently have a diagnosis of depression? Yes ☐ No ☐

Appendix B Defense and Veteran's Pain Rating Scale (DVPRS)

Please record a response below that represents your **average** pain rating over the past **3 months** by placing an "X" over the appropriate number.

Defense and Veterans Pain Rating Scale

Appendix C

PITTSBURGH SLEEP QUALITY INDEX

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

- a) Cannot get to sleep within 30 minutes

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- b) Wake up in the middle of the night or early morning

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- c) Have to get up to use the bathroom

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- d) Cannot breathe comfortably

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- e) Cough or snore loudly

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- f) Feel too cold

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- g) Feel too hot

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

- h) Had bad dreams

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

i) Have pain

Not during the Less than Once or twice Three or more
past month _____ once a week _____ a week _____ times a week _____

j) Other reason(s), please
describe _____

How often during the past month have you had trouble sleeping because of this?

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the Less than Once or twice Three or more past
 month _____ once a week _____ a week _____ times a week _____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the Less than Once or twice Three or more past
 month _____ once a week _____ a week _____ times a week _____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____

Only a very slight problem _____

Somewhat of a problem _____

A very big problem _____

STOP! DO NOT ANSWER QUESTION 10.

10. Do you have a bed partner or room mate?

No bed partner or room mate _____

Partner/room mate in other room _____

Partner in same room, but not same bed _____

Partner in same bed _____

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

a) Loud snoring

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

b) Long pauses between breaths while asleep

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

c) Legs twitching or jerking while you sleep

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

d) Episodes of disorientation or confusion during sleep

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

e) Other restlessness while you sleep; please
describe _____

Not during the Less than Once or twice Three or more past
month _____ once a week _____ a week _____ times a week _____

Appendix D
Individual Work Performance Questionnaire (IWPQ)

Instructions:

The following questions relate to how you carried out your work during the past 3 months. In order to get an accurate picture of your conduct at work, it is important that you complete the questionnaire as carefully and honestly as possible. If you are uncertain about how to answer a particular question, please give the best possible answer. The questionnaire will take about 5 minutes to complete. The questionnaire is completely anonymous: your answers will not be seen by your supervisor(s) or colleagues.

Scale 1: Task performance (5 items)					
In the past 3 months...	Seldom	Sometimes	Regularly	Often	Always
1. I was able to plan my work so that I finished it on time.	☐	☐	☐	☐	☐
2. I kept in mind the work result I needed to achieve.	☐	☐	☐	☐	☐
3. I was able to set priorities.	☐	☐	☐	☐	☐
4. I was able to carry out my work efficiently.	☐	☐	☐	☐	☐
5. I managed my time well.	☐	☐	☐	☐	☐
Scale 2: Contextual performance (8 items)					
In the past 3 months...	Seldom	Sometimes	Regularly	Often	Always
6. On my own initiative, I started new tasks when my old tasks were completed.	☐	☐	☐	☐	☐
7. I took on challenging	☐	☐	☐	☐	☐

tasks when they were
available.

8.	I worked on keeping my
job-related knowledge
up-to-date.	☐	☐	☐	☐	☐
9.	I worked on keeping my
work skills up-to-date.	☐	☐	☐	☐	☐
10.	I came up with creative
solutions for new
problems.	☐	☐	☐	☐	☐
11.	I took on extra
responsibilities.	☐	☐	☐	☐	☐
12.	I continually sought new
challenges in my work.	☐	☐	☐	☐	☐
13.	I actively participated in
meetings and/or
consultations.	☐	☐	☐	☐	☐

Scale 3: Counterproductive work behavior (5 items)

In the past 3 months...	Never	Seldom	Sometimes	Regularly	Often
14. I complained about
minor work-related
issues at work.	☐	☐	☐	☐	☐
15. I made problems at work
bigger than they were.	☐	☐	☐	☐	☐
16. I focused on the negative
aspects of situation at
work instead of the
positive aspects.	☐	☐	☐	☐	☐
17. I talked to colleagues
about the negative
aspects of my work.	☐	☐	☐	☐	☐

18. I talked to people outside
the organization about
the negative aspects of
my work.

☐☐☐☐☐

Appendix E

Naval Medical Center San Diego IRB Approval Letter

Clinical Investigation Department
Naval Medical Center, San Diego
34800 Bob Wilson Drive, Suite 5
San Diego, CA 92134-1005
Tel: (619) 532-8125
E-mail: Johanna.peterson2.civ@mail.mil

23 Mar 2020

From: NMCSDB IRB, Clinical Investigation Department To:

Kathleen McChesney, MD

Subj: FINAL APPROVAL OF CLINICAL INVESTIGATION PROGRAM (CIP) CIP # NMCSDB.2019.0073 "Chronic Pain, Sleep Disruption, and Work Performance in the Military"

Ref: (a) NAVMEDCEN SANDIEGOINST 6500.9A
(b) SECNAVINST 3900.39E CH-1

Action: APPROVED
Risk Level: Minimal Risk
Review Type: Expedited Review
Review Date: 4 March 2020
EIRB Ref: 924157

1. Members of the Institutional Review Board (IRB) have reviewed and recommended approval of your application and found that it meets the criteria specified in 45 CFR 46.111, as reported in the 4 March 2020 IRB Meeting Minutes. The IRB members reviewed all documents attached to the original submission, including the protocol, scientific review, investigator training and conflict of interest statements, DSA Checklist and Timeline.

Naval Medical Center San Diego holds Office of Human Research Protections Federal Wide Assurance number FWA00002342, #IRB00002061 and DOD Navy Assurance number P60022. The Institutional Official concurred with the IRB Chair recommendation for approval on 23 March 2020.

You may begin your study once all agreements, as applicable, are in place.

2. **ADVERSE EVENT (AE) REPORTING:** All problems that could possibly affect subject safety must be reported to the IRB within five days; serious AEs must be reported within 24 hours. All deaths, whether or not they are directly related to study procedures, must be reported.
3. **AMENDMENTS:** Prior IRB approval is required before implementing any changes to the protocol, including investigator additions or deletions, edits to consent documents or any other modifications to the documentation contained in the original submission package.
4. **EXPIRATION DATE:** Per Federal Policy for the Protection of Human Subjects (the Common Rule). The revised Common Rule, effective January 21, 2019, HHS 45 CFR Part 46 and pursuant to DoD 32 CFR Part 219. 109(f)(1)(iii)(A), under the updated Common Rule, the requirement for annual continuing review is no longer required for this minimal risk study. Although Continuing Review is not required, this study is still purview to Human Research Protection Office inspections. A final report is required to be submitted to the IRB prior to completion/closure.
5. **ARTICLES/ABSTRACTS/POSTERS:** If you wish to submit an item for publication or presentation, it must be submitted to the CID Medical Editor, please contact CID for assistance with preparation and approval process.
6. The Principal Investigator is responsible for obtaining final authorization to begin implementation and recruitment at approved satellite sites.

Please contact the NMCSDB Research Administration Division (RAD) if you have any questions.

Robert M. Marks, MD
CDR, MC, USN
Chairman, Institutional Review Board
Naval Medical Center San Diego

IR

Appendix F

University of San Diego IRB Approval Letter

Mar 25, 2020 3:37 PM PDT

Jeffrey Ransom

Hahn School of Nursing & Health Science

Re: Expedited - Initial - IRB-2020-333, Chronic Pain, Sleep Disruption, and Work Performance in the Military

Dear Jeffrey Ransom:

The Institutional Review Board has rendered the decision below for IRB-2020-333, Chronic Pain, Sleep Disruption, and Work Performance in the Military.

Decision: Approved

Selected Category: 7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Findings: None

Research Notes:

Internal Notes:

Note: We send IRB correspondence regarding student research to the faculty advisor, who bears the ultimate responsibility for the conduct of the research. We request that the faculty advisor share this correspondence with the student researcher.

The next deadline for submitting project proposals to the Provost's Office for full review is N/A. You may submit a project proposal for expedited or exempt review at any time.

Sincerely,

Dr. Thomas R. Herrinton

Administrator, Institutional Review Board

Office of the Vice President and Provost

Hughes Administration Center, Room 214

5998 Alcalá Park, San Diego, CA 92110-2492

Phone (619) 260-4553 • Fax (619) 260-2210 • www.sandiego.edu

Appendix G

Recruitment Flyer

Volunteers Needed for Research Study on Chronic Pain, Sleep, and Work Performance

Do you have chronic pain? You may be eligible for a research study that could provide better understanding of the impacts of chronic pain on work performance among military service members.

You may qualify if you

- Are Active Duty Military
- Are Between the ages of 18-65
- Have a chronic pain diagnosis
- Are currently enrolled in the Pain Medicine Clinic at Naval Medical Center San Diego

Potential Benefits

Participating in this study may improve understanding and future care for military members with a chronic pain diagnosis

Participation Involves

- A one time visit during a regularly scheduled provider appointment
- Completion of demographic information, medical history, and questionnaires designed to examine pain, sleep status, and work performance

Location: Naval Medical Center San Diego 34800 Bob Wilson Dr. San Diego, CA 92134

FOR MORE INFORMATION

Please contact Ms. Nicole DeFord at (619) 532-7226, email nicole.e.deford.ctr@mail.mil

Appendix H

Informed Consent Form (ICF) and Experimental Research Subject's Bill of Rights

Naval Medical Center San Diego (NMCSD)
CONSENT TO PARTICIPATE IN RESEARCH

Principal Investigator: Dr. Kathleen McChesney, Psy.D.; Phone: 619-556-8097

The purpose of this study is to examine the associations between chronic pain and sleep disruption in the context of work performance among active duty service members. Examining these relationships is critical to understanding the real impact of these conditions on our nations fighting forces.

1. PROTOCOL TITLE: Chronic Pain, Sleep Disruption, and Work Performance in the Military

You may be eligible to take part in this research study. This form gives you important information about the study.

Please take time to review this information carefully. You should talk to the researchers about the research study and ask them any questions you have. You may also wish to talk to others (for example, your friends, family, or your personal physician) about your participation in this study. If you decide to take part in this research study, you will be asked to sign this document. Before you sign this document, be sure you understand what the research study is about, including the risks and possible benefits to you.

Please tell these researchers if you are taking part in another research study.

You do not have to take part if you do not want to. You may also leave the research study at any time. If you choose not to take part in this research study or if you leave the study before it is finished, there will be no penalty.

Your decision will not affect your future care at Naval Medical Center San Diego (NMCSD).

2. WHAT IS THE PURPOSE AND DURATION OF THIS RESEARCH AND WHO WILL TAKE PART?

You are being asked to take part in this research study because you are an active duty military member enrolled at NMCSD and you also are being treated by the Pain Medicine Clinic for chronic pain. The purpose of this research study is to learn about the relationships between chronic pain, sleep disturbance, and work performance in military populations. The duration of participation per visit is approximately 30 minutes and participation will concluded after 1 visit. There will be about 125 people taking part in the study at NMCSD, over a period of 1 year.

During the study, you will be asked to complete a series of questionnaires asking about medical history, pain levels, sleep quality, and work performance.

At the end of this research study the clinical results, including research results about you will not be shared with you.

3. SCREENING PROCESS TO QUALIFY FOR PARTICIPATION IN THIS STUDY

Before you can take part in this study, you will need to answer some questions so that the Investigator can confirm that you qualify for the study. This is called the "Screening Process".

4. WHAT WILL HAPPEN IF YOU DECIDE TO BE IN THIS RESEARCH?

You will: Undergo informed consent and then be asked to complete a series of questionnaires. These questionnaires will take approximately 30 minutes to complete and will ask questions about medical history, pain levels, sleep quality, and work performance.

5. WHAT ARE THE RISKS OR DISCOMFORTS FROM BEING IN THIS RESEARCH?

If you choose to take part in this study, there is a risk of:

At times, disclosure of psychosocial and functional symptoms associated with chronic pain and/or insomnia can lead to psychological distress, and symptoms of depression and/or anxiety. Distress secondary to disclosure is considered to be rare and a low risk of participation. Second, there is a risk of loss of confidentiality associated with this study.

Although efforts are made to protect your research study records, there is always a risk that someone could get access to the personal information in your medical records or other information researchers have stored about you.

6. WHAT ARE THE POSSIBLE BENEFITS FROM THIS RESEARCH?

There are no direct benefits to you for taking part in the study. However, others may benefit in the future from the information learned during this study. The possible benefits to others are increased knowledge which may inform future research and/or treatment of chronic pain and sleep disturbance.

7. WHAT ARE THE ALTERNATIVES TO TAKING PART IN THIS RESEARCH?

Your alternative is not to participate in this research.

8. IS THERE COMPENSATION FOR YOUR PARTICIPATION IN THIS RESEARCH?

No, you will not receive any compensation for participating in this study.

9. ARE THERE COSTS FOR PARTICIPATING IN THIS RESEARCH?

No, there are no costs to you for taking part in this research study.

10. WHO IS CONDUCTING THIS RESEARCH?

This research is being conducted by investigators in the Department of Anesthesiology at the Naval Medical Center San Diego (NMCSO).

11. STUDY SPONSOR (the organizations or persons who oversee the study and are responsible for analyzing the study data):

As the sponsor of this research, the Department of Defense may have access to your research data in accordance with DoDI 3216.02.

12. SOURCE OF FUNDING:

This is an unfunded research study.

13. PRINCIPAL INVESTIGATOR (the person(s) responsible for the scientific and technical direction of the study):

Dr. Kathleen McChesney, Psy.D.

14. LOCATION OF THE RESEARCH:

Naval Medical Center San Diego

15. DISCLOSURE OF FINANCIAL INTERESTS AND OTHER PERSONAL ARRANGEMENTS:

No study personnel have any personal financial interests associated with the conduct or outcomes of this research study.

16. WHO WILL SEE MY INFORMATION (PRIVACY) AND HOW WILL IT BE PROTECTED (CONFIDENTIALITY)?

Records of your participation in this research study may only be disclosed in accordance with state and federal law, including the Federal Privacy Act, 5 U.S.C.552a, and its implementing regulations. DD Form 2005, Privacy Act Statement - Military Health Records, contains the Privacy Act Statement for the records. A copy of DD Form 2005 can be given to you upon request, or you can read on-line at: <http://www.dtic.mil/whs/directives/infomgt/forms/efoms/dd2005.pdf>.

The research team will keep your research records. These records may be looked at by staff from the Department of Anesthesiology, the Institutional Review Board (IRB), and the DoD Higher Level Review as

part of their duties. These duties include making sure that the research participants are protected. Confidentiality of your records will be protected to the extent possible under existing regulations and laws but cannot be guaranteed.

Procedures to protect the confidentiality of the data in this study include but are not limited to: A study key will be used to link your name with a study ID. All research data collected from you will be coded with this ID and will not contain your name or other identifying information about you. The study key will be kept separate from any forms containing personal information and any study data. Informed Consent forms and the study key will be the only forms that contain identifying information and will be physically secured in a locked office. Only trained research personnel will collect Informed Consent and handle sensitive information. All electronic databases will be password protected and only accessed by approved study personnel.

Researchers will make every effort to protect your privacy and confidentiality; however, there are risks of breach of information security and information loss.

By signing this document, you give your permission for information gained from your participation in this research study to be published in literature, discussed for educational purposes, and used generally to further science. You will not be personally identified; all information will be presented as anonymous data.

Complete confidentiality cannot be promised for military personnel, because information regarding your health may be required to be reported to appropriate medical or command authorities to ensure the proper execution of the military mission, including evaluation of fitness for duty.

Research Staff, the Institutional Review Board (IRB) of the Naval Medical Center San Diego, and the Department of Defense (DoD) will have access to your records and agree to safeguard your protected health information by using and disclosing it only as permitted by you in this consent or as directed by state and federal law.

17. WHAT HAPPENS IF YOU ARE INJURED AS A RESULT OF THIS RESEARCH?

If you think that you have a research-related injury, notify your Principal Investigator immediately at 619-556-8097.

If you are injured because of your participation in this research and you are a DoD healthcare beneficiary (e.g., active duty military, dependent of active duty military, retiree), you are authorized space-available medical care for your injury within the DoD healthcare system, as long as you remain a DoD healthcare beneficiary. This care includes, but is not limited to, free medical care at DoD hospitals or DoD clinics.

If you are injured because of your participation in this research and you are not a DoD healthcare beneficiary, you are authorized space-available medical care for your injury at a DoD hospital or an DoD clinic; medical care charges for care at a DoD hospital or a DoD clinic will be waived for your research-

related injury. If you obtain care for research-related injuries outside of a DoD or DoD hospital or clinic, you will not be reimbursed for those medical expenses.

For DoD healthcare beneficiaries and non-DoD healthcare beneficiaries: Transportation to and from hospitals or clinics will not be provided or paid for by DoD. Unless you are covered by TRICARE, no DoD reimbursement is available if you incur medical expenses to treat research-related injuries. No compensation is available for research-related injuries. You are not waiving any legal rights.

18. WHAT HAPPENS IF I WITHDRAW FROM THIS RESEARCH?

You may withdraw your consent at any time and stop participating in this research study without affecting your eligibility for care or any other benefits to which you are entitled. Should you choose to withdraw, you must notify Dr. Kathleen McChesney at 619-556-8097 to ensure your timely removal from the study. If you do not follow these procedures, you may not have your data withdrawn from the study efficiently.

If you are receiving treatment as part of this research study, you will no longer be eligible for such research-related treatment. Contact your personal physician to discuss medical treatment for your condition.

Please note that withdrawing your consent to participate in this research does not fully revoke your HIPAA Authorization Form to use/disclose your protected health information. To make that revocation, please send a letter to the principal investigator as discussed in the HIPAA Authorization Form.

The principal investigator of this research study may terminate your participation in this research study at any time if she determines this to be in your best interest, if you are unable to comply with the procedures required, or if you no longer meet eligibility criteria.

19. VOLUNTARY PARTICIPATION:

The decision to take part in this research study is completely voluntary on your part. You will be informed if significant new findings develop during the course of this research study that may relate to your decision to continue participation.

20. CONTACT INFORMATION:

Principal Investigator (PI)

The Principal Investigator or a member of the research staff will be available to answer any questions throughout this study.

Principal Investigator: Dr. Kathleen McChesney, Psy.D.

Phone: 619-556-8097

Mailing Address: 2450 Craven St., Bldg. 3300, San Diego, CA 92136

A signed and dated copy of this document will be given to you.

SIGNATURE OF PARTICIPANT

Printed Name of Participant

Signature of Participant

Date

SIGNATURE OF INDIVIDUAL ADMINISTERING CONSENT

(Can only be signed by an investigator or staff approved to administer consent)

Printed Name of Administering Individual

Signature of Administering Individual

Date

Appendix I

HIPAA Authorization

Principal Investigator (PI) Name and Rank: Dr. Kathleen McChesney, Psy.D.

Corps and Service/Organization: Medical Corps (MC), Naval Medical Center San Diego (NMCSD)

Title of Research Study: Chronic Pain, Sleep Disruption, and Work Performance in the Military

I. Purpose of this Document

An Authorization is your signed permission to use or disclose your health information. The Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule, as implemented by the Department of Defense (DoD), permits the Military Health System (MHS) to use or disclose your health information with a valid Authorization. The MHS is defined as all DoD health plans and DoD health care providers that are organized under the management authority of, or in the case of covered individual providers, assigned to or employed by, the Defense Health Agency (DHA), the Army, the Navy, or the Air Force. A valid Authorization must include the core elements and required statements as contained in this document.

Please read the information below and ask questions about anything you do not understand before deciding to give permission for the use and disclosure of your health information. II. Authorization

The following describes the purposes of the requested use and disclosure of your health information: The purpose of this study, entitled Associations Between Pain and Sleep Disruption on Work Performance in the Military, is to examine the associations between chronic pain and sleep disruption in the context of work performance among active duty service members. Examining these relationships is critical to understanding the real impact of these conditions on our nations fighting forces.

A. What health information will be used or disclosed about you?

Data used for this study will be collected from you directly and will consist of self-report questionnaires which ask about medical history, pain levels, sleep quality, and work performance. No information about you will be obtained from your medical record.

B. Who will be authorized to use or disclose (release) your health information?

Health information about you will be collected directly from you. Only approved research personnel will be authorized to use or disclose the information you provide for this study.

C. Who may receive your health information?

Your information may be shared with any of the following:

- Investigators and other approved research staff.
- State and Federal agencies which have authority over the research, Naval Medical Center San Diego or patients, such as the Department of Health and Human Services (DHHS), the Food and Drug Administration (FDA), the National Institute of Health (NIH), the Office of Human Research Protections (OHRP), and the Department of Social Services (DSS) or other. • NMCS Institutional Review Board (IRB)

1

Version: 7/5/17

D. What if you decide not to sign this Authorization?

The MHS **will not** condition (withhold or refuse) treatment that is not part of this study, payment, enrollment, or eligibility for benefits on whether you sign this Authorization. **E. Is your health information requested for future research studies?**

No, your health information is not requested for future research

studies. **F. Can you access your health information during the study?**

You may have access to your health information at any time, unless your identifiers are permanently removed from the data.

G. Can you revoke this Authorization?

- You may change your mind and revoke (take back) your Authorization at any time. However, if you revoke this Authorization, any person listed above may still use or disclose any already obtained health information as necessary to maintain the integrity or reliability of this research.
- If you revoke this Authorization, you may no longer be allowed to participate in this research study.
- If you want to revoke your Authorization, you must write to:

Dr. Kathleen McChesney, Psy.D., 2450 Craven St., Bldg. 3300, San Diego, CA 92136.

619-556-8097

H. Does this Authorization expire?

No, it does not expire

I. What else may you want to consider?

- No publication or public presentation about the research described above will reveal your identity without another signed Authorization from you.
- If all information that does or can identify you is removed from your health information, the remaining de-identified information will no longer be subject to this Authorization and may be used or disclosed for other purposes.

- In the event your health information is disclosed to an organization that is not covered by HIPAA, the privacy of your health information cannot be guaranteed.

2

Version: 7/5/17

Signature of Research Participant or Personal Representative:

Your signature acknowledges that:

- You authorize the MHS to use and disclose your health information for the research purposes stated above.
- You have read (or someone has read to you) the information in this Authorization.
- You have been given a chance to ask questions, and all of your questions have been answered to your satisfaction.

Participant Signature_____
Date_____
Participant Printed Name

If the personal representative signs on a participant's behalf, then the personal representative must provide verification of their authority under applicable state law.

Personal Representative Signature

Date

Personal Representative Printed Name

Description of the Personal Representative's
Authority