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Experience of Persistent Pain Among Military Service Members Participating in an Interdisciplinary Intensive Outpatient Program

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EXPERIENCE OF PERSISTENT PAIN AMONG MILITARY SERVICE MEMBERS PARTICIPATING IN AN INTERDISCIPLINARY INTENSIVE OUTPATIENT PROGRAM

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PREFACE

The views expressed in this document are those of the author and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

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ABSTRACT

Persistent pain is one of today's most complex issues in healthcare. In the U.S. military, persistent pain affects close to half of the service members who have deployed overseas and up to 73.2% of service members and veterans experiencing persistent pain. Interdisciplinary pain management, considered one of the most effective ways to manage persistent pain, utilizes the biopsychosocial model that illustrates the dynamic interaction between the physiological, psychological and social factors involved in the experience of persistent pain. Effective interdisciplinary programs address all components of the model and result in better coping skills to self-manage persistent pain, decreased fear of pain and re-injury, decreased pain catastrophizing, improved physical and psychological functioning and overall quality of life.

The process of change, while in an interdisciplinary pain program, is multifaceted and difficult to assess using conventional unidimensional scales. Multidimensional scales are commonly used to assess the components of persistent pain such as attitudes, beliefs, specific body region disability and quality of life but they may still not capture the full impact of an intervention on the experience of pain. A variety of methods including patient narrative and observation, daily assessments using ecological momentary assessment and change in patient activation can provide additional insight into the process of change in those with persistent pain. The Patient Activation Measure (PAM) was developed to assess this construct which combines concepts of self-efficacy, locus of

control and other psychosocial components and has been used in healthy individuals and those with chronic conditions. Ecological momentary assessment (EMA) can be a reliable method to track temporal changes and contextual associations in various settings and has been utilized in various forms to monitor daily pain or other symptoms.

Three specific aims were proposed in this dissertation. The research study included patient participants who were active duty military service members suffering from persistent pain who were determined eligible and were enrolled in the Intensive Outpatient Pain Program at the D.D. Eisenhower Army Medical Center. Staff members who were actively working in the IOP were also recruited for the qualitative portion of the study. Prospective data was collected between September 2018 and December 2018 for the analysis in specific aim 1 and 3. Retrospective data was extracted from January 2017 through August 2018 for the quantitative analysis in specific aim 2.

Specific aim 1 was to gain insight into the process of change in the understanding of persistent pain through consideration of past and present experiences, psychosocial factors, personal and work relationships and stressors, attitudes, goals and future expectations of U.S. military service members attending an intensive outpatient program. Patient participants were interviewed at four time points during the program. Staff participants were interviewed once and a researcher was a participant-observer during the group components of the program. Data was analyzed with a constant comparative method using a preliminary codebook with organizational and theoretical categories. Iterative coding was completed with themes identified across all interviews addressing changes in perception of pain, attitudes, barriers and enablers, impact of past and present experiences and effectiveness of the program on future goals. Categorization of patient

participants by similarities in experience was concurrent with data collection and analysis. Staff interviews and observation notes were coded using patient participant codebook and used to triangulate the data.

Specific aim 2 was to examine the change in the Patient Activation Measure and assess its relationship with measures of fear of movement, pain intensity, pain interference, and physical function assessment in an intensive outpatient program for persistent pain. Pre and post-intervention measures included: The Patient Activation Measure-13 (PAM-13), Defense and Veterans Pain Rating Scale (DVPRS), Tampa Scale for Kinesiophobia-17 (TSK-17), and physical function assessment which included 1-minute of push-ups, deadlift and a shuttle run. Paired t-tests and Spearman rank correlation were computed to assess changes pre to post-program and relationships of PAM-13 with the other outcome measures.

Specific aim 3 was to test the feasibility and acceptability of using a mobile app to monitor daily self-reported pain, psychosocial indicators and attitudes in an intensive outpatient program for persistent pain. Commercially available PACO© app was used in the study. Participants downloaded the app to their smartphones and answered 12 questions daily including weekends. Descriptive statistics were calculated for compliance rates and all other variables. Means and standard deviations were calculated for continuous variables, frequencies and percentages were calculated for categorial variables. Pain trajectories and stress levels for all participants were graphed to assess any trends.

For specific aim 1, five categories of participants emerged during analysis based on the observed and reported process of change: (1) participants already well-versed in many of the biopsychosocial aspects of pain, fine-tuning their skills; (2) participants with life-altering realizations changing their lives in all aspects during the program; (3) participants with partial buy-in focused more toward the physical function and performance; (4) participant with partial buy-in focused more on the psychosocial changes; and (5) participants for whom the biomedical model prevailed and despite some positive changes, the end result was seen as a failure to satisfactorily address their condition.

For specific aim 2, the sample included 105 participants (70.5% male), majority were enlisted (95.2%). The average age of participants was 29.02 years and pain duration was 56.68 months. The average patient activation score increased from level 3 (59.51, SD=14.13) to level 4 (69.67, SD=16.50). The TSK-17 score for the entire sample decreased by 4.44 points to 35.63, below the commonly used cut-off score of 37. All DVPRS components (pain intensity in last 24 hours, pain interference with activity, pain interference with sleep, pain affecting mood, pain affecting stress) showed a statistically significant decrease, with the largest improvement reported for quality of sleep (MD=1.44, $p<.001$, $d=.778$). No significant correlations were detected between baseline PAM-13 scores and reported change on all outcome measures and physical function assessment. Significant negative correlations were found between PAM-13 and TSK-17 at both baseline and upon completion of the program.

For specific aim 3, 11 of the 22 participants completed 100% of the daily survey with overall compliance of 91.1%. Participants reported receiving social support 77.5%

of the days reported and considered it beneficial 91.4% of the time. The most frequent types of social support received were esteem support (69.4%), informational support (56.5%), and emotional support (53.7%). Participants reported making progress toward their individual goals 73.0% of the days reported. Pain and stress level trajectories showed high variability in between and within-participants throughout the 3 weeks. Majority of passive and active components of the program were considered beneficial regardless of whether they increased or decreased pain.

The process of change in persistent pain varied among the military service members participating in IOP with majority describing benefits such as increased physical performance, improved mood and relationships, acceptance of pain, decreased pain and increased patient activation. Significant changes took place in as little as 3 weeks even for individuals who have had persistent pain for many years. Future research should focus on the on-going process of change following the completion of the treatment program to determine continued changes and whether the changes are related to physical and psychosocial function and return to full military duty. EMA using a smartphone application for monitoring various outcome measures during an intensive outpatient program for persistent pain may be a beneficial tool for additional monitoring of participant progress in the program and beyond.

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LIST OF ABBREVIATIONS

ACFT ..... Army Combat Fitness Test

APFT ..... Army Physical Fitness Test

AR ..... Army Regulation

BAMC ..... Brooke Army Medical Center

CBT ..... Cognitive Behavioral Therapy

DDEAMC ..... Dwight D. Eisenhower Army Medical Center

DHA ..... Defense Health Agency

DoD ..... Department of Defense

DVPRS ..... Defense and Veterans Pain Rating Scale

IOP ..... Intensive Outpatient Program

MHS ..... Military Health System

OEF ..... Operation Enduring Freedom

OIF ..... Operation Iraqi Freedom

OPAT ..... Occupational Physical Assessment Test

PAM ..... Patient Activation Measure

PTSD ..... Post-Traumatic Stress Disorder

RHC-A ..... Regional Health Command - Atlantic

TDY ..... Temporary Duty Assignment

TSK ..... Tampa Scale for Kinesiophobia

VHA ..... Veterans Health Administration

VA ..... Veterans Administration

CHAPTER 1

INTRODUCTION

Persistent pain is a national public health concern in the United States (U.S.) with approximately 20-30% Americans affected and it is even more prevalent among military service members and veterans with up to 73.2% experiencing pain (Institute of Medicine Committee on Advancing Pain Research & Education, 2011; Van Den Kerkhof, Carley, Hopman, Ross-White, & Harrison, 2014). The increased tempo of military training and deployments in the last 17 years, due to involvement in multiple war zones, has brought increased number of deployments with less recuperation and dwell time or time spent at home between deployments. This has led to a substantial increase in health issues including persistent pain. Close to half of service members returning from a combat deployment, suffer from some type of persistent pain (Toblin, Quartana, Riviere, Walper, & Hoge, 2014). Reduction of active duty service members available to deploy places other healthy service members at greater risk for developing similar issues because they will deploy more often with less time to recuperate. This results in overall decreased military readiness, or the ability to accomplish assigned tasks and missions, posing a threat to national security. Approximately 5% of Soldiers have permanent, limiting-duty profiles for chronic conditions and VA disability claims continue to climb as service members retire or are medically discharged with an average of 300,000 new recipients annually (U.S. Army Surgeon General Report, 2016; Veterans Benefits Administration, 2015).

The creation of an Army Pain Management Task Force in 2009 was the first step to addressing pain in the military and the Veterans Health Administration through assessment of existing practices and summarizing clear recommendations for change (Office of the Army Surgeon General Pain Management Task Force, 2010). Since then the military has invested in the development of interdisciplinary pain management centers in order to improve treatment of all pain, including persistent pain. While biomedical methods of treating persistent pain such as medications and interventional pain management are still being used and are effective for certain conditions, they often lack in effectiveness for persistent pain resulting in service members seeking alternative treatment methods.

Interdisciplinary pain management, including Intensive Outpatient Program (IOP) for persistent used in this research study, has shown to be effective in increasing coping skills to self-manage persistent pain, decreasing fear of pain and re-injury, decreasing pain catastrophizing, improving physical and psychological functioning and overall quality of life (Gatchel et al., 2009; Katz, Patterson, & Zacharias, 2019; Murphy, Phillips, & Rafie, 2016). Interdisciplinary management for persistent pain has also shown to be effective in decreasing health care utilization (D. D. McGeary et al., 2012).

The process of change, while in an interdisciplinary pain program, is multifaceted and difficult to assess using conventional unidimensional scales (Salaffi, Sarzi-Puttini, & Atzeni, 2015). Numerous multidimensional scales are used to assess the components of persistent pain including pain related attitudes, beliefs, specific body region disability or quality of life which assist in capturing the complexity of the persistent pain experience

(Younger, McCue, & Mackey, 2009). These measures may still not capture the process of change and full impact of an intervention on one's pain (Penney & Haro, 2019).

Patient activation, the knowledge, confidence and skills to self-manage one's own health, is strongly related to numerous health-related outcomes and behaviors such as adhering to medication use or eating breakfast consistently (Greene & Hibbard, 2012). The Patient Activation Measure (PAM) was developed to assess this construct which combines concepts of self-efficacy, locus of control and other psychosocial components and has been used in individuals with chronic conditions and healthy individuals (Hibbard, Stockard, Mahoney, & Tusler, 2004). An increasing number of patient-centered medical home clinics are measuring patient activation to help tailor care and treatment plans (Greene & Hibbard, 2012). Interventions shown to successfully increase activation levels focus on skill development, problem solving, peer support, changing the social environment, and tailoring the intervention to an individual's activation level (Hibbard & Greene, 2013; Roberts et al., 2016). While various interventions have been shown to increase patient activation, no significant change in patient activation was noted after a self-management program for persistent pain based on elements of cognitive-behavioral therapy demonstrating it is unclear what type of intervention may be beneficial in this population (Nost, Steinsbekk, Bratas, & Gronning, 2018).

Ecological momentary assessment (EMA) can be a reliable method to track temporal changes and contextual associations in various settings and has been utilized in various forms to monitor daily pain or other symptoms (May, Junghaenel, Ono, Stone, & Schneider, 2018; Rodriguez et al., 2017; Suso-Ribera et al., 2018). EMA has been used in monitoring daily persistent pain initially using paper diaries and now more commonly

using electronic diaries or smartphone apps (Shiffman, Stone, & Hufford, 2008). As of 2018, 77% of American use smartphones therefore EMA studies using phone apps can be extremely convenient way to answer daily survey questions and can be an additional tool to help in understanding symptoms in daily life or during an intervention (Pew Research Center, 2018; Runyan & Steinke, 2015).

Gaps in Knowledge

Assessing persistent pain is complex and currently the use of various multidimensional tools is becoming more common to provide a more holistic assessment that includes an evaluation of physical function, cognitive, behavioral and emotional factors including sleep quality, coping strategies, healthy or unhealthy behaviors, and expectations (Dennis C. Turk, Fillingim, Ohrbach, & Patel, 2016). These measures have improved the understanding of pain but are not able to provide information on the process of change. Qualitative methods, used less commonly, can explore the depth of benefit or lack of benefit, and changes that were expected, unexpected or unmeasurable quantitatively (Penney & Haro, 2019). Patient narrative and observed behavior during an intervention like the IOP necessitates further exploration and may provide context to inform the process of change in participating individuals. It may also assist with developing and revising the intervention further, resulting in increased support for interdisciplinary program as an effective treatment for persistent pain.

Patient activation has been assessed in healthy individuals and those with chronic conditions such as diabetes or cardiovascular disease (Donald et al., 2011; Fowles et al., 2009). Higher PAM scores are associated with improved health outcomes, decreased

hospitalization and emergency room utilization (Kinney, Lemon, Person, Pagoto, & Saczynski, 2015). An increasing number of patient-centered medical home clinics are measuring patient activation to help tailor care and treatment plans (Greene & Hibbard, 2012). There is a lack of studies assessing patient activation changes after interventions for persistent pain, which could determine the effectiveness of intervention and help tailor it. Patient activation has also not been assessed in individuals receiving interdisciplinary pain management treatment. Evaluating patient activation in an intensive pain program can gauge the program's effectiveness in increasing activation and may demonstrate whether the program changes understanding, emotional response and confidence in self-management of persistent pain. Patient activation has also not been assessed in military service members and may provide additional insight on activation in this specific population.

EMA has been utilized in assessing pain, fatigue, and other symptoms in musculoskeletal conditions (lower back pain), neurological conditions (multiple sclerosis), psychological conditions (depression) and various other chronic conditions such as fibromyalgia (Axen & Bodin, 2016; Garcia-Palacios et al., 2014; Iacob, Donaldson, Neikrug, Nakamura, & Okifuji, 2016; Kratz, Murphy, & Braley, 2017). EMA not been utilized while individuals participate in an interdisciplinary intensive pain management program. Daily assessments can provide a more comprehensive, multidimensional assessment of the evolution of pain and facilitate a deeper understanding of the participants' experience in intensive outpatient programs, rather than simply comparing pre and post intervention measurements. This has the potential to

improve the knowledge of symptom patterns throughout the program and refine the treatment for maximum benefit.

Research Objectives and Aims

The main objective of this research was to analyze the experience of persistent pain and process of change in service members enrolled in an IOP to gain a deeper understanding of the characteristics, experiences, relationships and health care resources that contribute to the outcomes in the program and to assess change in patient activation as a result of this intervention. This research also explored the feasibility and acceptability of using smartphone technology to monitor progress in an IOP. The research was guided by a conceptual model that considers treatment delivery system, healthcare providers and community components in the process of change that lead to the outcomes including changes in physical function, psychosocial components and acceptance of pain.

Specific Aim 1: To improve understanding of the experience of persistent pain in military service members participating in an Intensive Outpatient Pain Program (IOP) to inform further intervention.

Research Question 1: How does the course of persistent pain and self-perceived disability evolve throughout the IOP?

Research Question 2: How do past and present life experiences affect participation in the IOP and development of short and long-term goals?

Research Question 3: What role do health care providers and community components such as social support, family, and military have in a service member's experience of persistent pain?

Specific Aim 2: To assess the change in patient activation following an intensive outpatient program for military service members with persistent pain and to determine whether patient activation at baseline is associated with outcomes in the program including kinesiophobia, pain interference, and physical function.

Research Hypothesis 1: Patient Activation Measure (PAM-13) scores will significantly increase upon completion of the intensive outpatient program.

Research Hypothesis 2: Measure of pain intensity will significantly decrease upon completion of the intensive outpatient program.

Research Hypothesis 3: Measures of pain interference will significantly decrease upon completion of the intensive outpatient program.

Research Hypothesis 4: Measure of fear of movement will significantly decrease upon completion of the intensive outpatient program.

Research Hypothesis 5: Measures of physical function will significantly increase upon completion of the intensive outpatient program.

Research Hypothesis 6: Patient Activation Measure (PAM-13) scores will be negatively associated with fear of movement at both baseline and upon completion of the program.

Research Hypothesis 7: Patient Activation Measure (PAM-13) scores will be negatively associated with pain intensity at both baseline and upon completion of the program.

Research Hypothesis 8: Patient Activation Measure (PAM-13) scores will be negatively associated with pain interference at both baseline and upon completion of the program.

Research Hypothesis 9: Patient Activation Measure scores (PAM-13) will be positively correlated with physical function assessment at both baseline and upon completion of the program.

Specific Aim 3: To explore the feasibility and acceptability of ecological momentary assessment using a smartphone application for daily reporting of pain, psychosocial indicators and attitudes of service members engaging in a treatment program for persistent pain.

Research Question 1: What are the compliance rates and satisfaction with daily completion of an ecological momentary assessment survey during a 3-week intensive outpatient program?

Research Question 2: What are service members' perceived pain and stress levels, attitudes about the program components, and social support perceptions as they progress through the program?

Research Question 3: How does the use of a smartphone application to assess daily pain, stress, social support and attitudes during a treatment program enhance the understanding of persistent pain?

Justification

Persistent pain is a complex problem that is still not fully understood and its definition and treatment continue to evolve as we learn more about it. This research study helps to refine the way we understand individuals with persistent pain by utilizing qualitative methods, assessing activation and monitoring the process of change while receiving an intervention. This research can also lead to enhancing interdisciplinary pain management by refining program components, timing and dosage to maximize benefits.

The military population has a higher prevalence of persistent pain than general population contributing in part to decreased overall military readiness, the number one priority of the military (Secretary of Defense, 2017; Van Den Kerkhof et al., 2014). Results from the study are useful to the Army Medical Department and Defense Health Agency in supporting the goal of improving care of military service members and improving medical readiness (U.S. Army Surgeon General Report, 2016). This makes the military a prime population to study persistent pain and results may be applied to veterans, retirees, and to the general population adding to the literature on understanding of persistent pain.

Overview

The next chapter (Chapter 2) includes a review of the literature on the evolution of pain theory, the biopsychosocial model for understanding and treatment of persistent

pain, and identifies the gaps in literature guiding this research. Chapter 3 describes the study design and methodology employed to answer the research questions. Chapter 4 presents the results of the research in three distinct manuscripts. Chapter 5 presents a summary of the findings and a discussion about the implications for practice and future research.

CHAPTER 2

BACKGROUND AND SIGNIFICANCE

This chapter will provide detail on persistent pain prevalence and its implications in the U.S. military. The evolution of pain theory and the most current explanation of persistent pain through the biopsychosocial model followed by a review of interventions for pain are discussed. Pain assessment methods and usefulness of qualitative methods to gain deeper understanding of the pain experience is presented followed by a discussion of interdisciplinary pain management program which is the setting for this research study.

Persistent Pain in the United States

Persistent pain is a significant public health concern. According to the *American Academy of Pain Medicine,* persistent pain affects approximately 100 million Americans (Institute of Medicine Committee on Advancing Pain Research & Education, 2011). The most common persistent pain conditions include lower back pain (27%), severe headaches (15%), knee pain (19%), and neck pain (15%) (Institute of Medicine Committee on Advancing Pain Research & Education, 2011). In the United States, the costs associated with persistent pain are between $560-$636 billion annually representing both health care costs and lost productivity (Institute of Medicine Committee on Advancing Pain Research & Education, 2011).

Various treatments have been utilized for persistent pain. In particular, opioid prescriptions for persistent pain have quadrupled in the last 20 years with no decrease in

prevalence or intensity of pain reported by those affected (CDC, 2011). This significant increase in prescription of opioids since the early 1990s, has led to the current opioid crisis in the United States (National Institute on Drug Abuse, 2017). Studies have shown that long-term effects of opioid therapy for persistent pain have been associated with many adverse outcomes including increased risk of overdose, opioid abuse, and other pathologies such as fractures and myocardial infarction (Chou et al., 2015). The statistics are worrisome with notable rates of opioid medication misuse (21-29%) and addiction (8-12%) in individuals with persistent pain (Vowles et al., 2015).

Due to the opioid crisis and overall lack of effectiveness in opioid use for persistent pain, there is an ongoing need for other, more effective treatments. Various agencies have been working to improve the understanding and treatment for pain. After several years of research, the National Institute of Health and the Institute of Medicine developed a 'comprehensive population health-level strategy' with recommendations on addressing pain education, prevention and treatment with the goal of reducing the burden of pain (National Institute of Health, 2016). Since 2009, the Department of Defense (DoD) and Veterans Health Administration (VHA) have made pain management, both acute and persistent, a priority for the military and veteran populations as rates of pain were increasing and treatment methods were not proving effective (Office of the Army Surgeon General, 2010; Office of the Army Surgeon General Pain Management Task Force, 2010). In addition to the DoD and VHA clinical guidelines for pain management, the Center for Disease Control (CDC), also issued guidelines for opioid use in persistent pain management to improve awareness and appropriate use of medications for pain (Dowell, Haegerich, & Chou, 2016; Rosenberg, Bilka, Wilson, & Spevak, 2018).

In 2016, the American Physical Therapy Association began a campaign called #ChoosePT, which raises awareness of the dangers of opioids and promotes use of other, safer and more effective alternatives to managing pain such as physical therapy (APTA, 2016; George, 2017). Additionally, integrative therapies such as cognitive-behavioral therapy, acupuncture, yoga, relaxation techniques, and others that do not include medications are being promoted for persistent pain by the National Institutes of Health's National Center for Complementary and Integrative Health, the Center for Disease Control and the National Cancer Institute, to improve not only provider but also the patient's knowledge and awareness of treatment options and risks involved (Y. C. Lin, Wan, & Jamison, 2017; Yun, Sun, & Mao, 2017).

Persistent Pain in the United States Military

The military population carries a higher risk of developing persistent pain compared to the general population with overall prevalence reported between 25.2% and 73.2% in all military veterans and 43-48% among Iraq (OIF) and Afghanistan (OEF) veterans (Higgins et al., 2014; Nahin, 2017; Van Den Kerkhof et al., 2014). Another study reported 44% of Soldiers with at least one combat deployment were experiencing persistent pain, compared to 26% of the general population (Toblin et al., 2014). In addition, 23.2% of combat veterans reported opioid use for pain within a past month (Toblin et al., 2014). Gironda and others (2006) reported 47% of combat veterans enrolled in a VA system had a diagnosis of persistent pain. The Institute of Medicine reported 50% of veterans suffer from persistent pain compared to 30% of the general population (Institute of Medicine Committee on Advancing Pain Research & Education, 2011).

In most recent history, the U.S. military has been involved in the Global War on Terrorism for over 16 years. The physical and psychological demands experienced by service members have increased with almost half (47%) of those that deployed to a combat zone, deploying more than once with short recuperation periods between deployments (Committee on the Assessment of the Readjustment Needs of Military Personnel, 2013). High physical and mental demands throughout a service member's career led to 50% of Soldiers diagnosed with an injury or injury related musculoskeletal condition in 2015; of those more than half were lower extremity training injuries with female Soldiers injured more frequently (59%) than male Soldiers (49%), resulting in over one million medical encounters and ten million days of limited duty, annually, many leading to persistent pain or some level of long-term disability (Olenick, Flowers, & Diaz, 2015; U.S. Army Surgeon General Report, 2016). Five percent of Soldiers have a permanent, duty-limiting profile due to a chronic condition that allows them to continue their service while many others have to be medically discharged (U.S. Army Surgeon General Report, 2016). The VA disability claims continue to steadily increase every year, averaging close to 300,000 new recipients annually with various musculoskeletal conditions, migraines, tinnitus, hearing loss, and PTSD as the most prevalent disabilities (Veterans Benefits Administration, 2015).

Conditions which often accompany a diagnosis of persistent pain and are more prevalent in the military veteran population include: post-traumatic stress disorder (PTSD) diagnosed in 36% of veterans, compared to 8% in the general population, depression in 14% of veterans, and up to 82% of service members have been diagnosed with at least a mild Traumatic Brain Injury (TBI) (Algire & Martyn, 2013; Olenick et al.,

2015). Another study found that of all veterans, those with persistent pain were more likely to be Black (OR=2.10, 95% CI 1.74-2.54), female (OR=1.38, 95% CI 1.13-1.68), enlisted (96.0%), have lower education levels (OR=0.60, 95% CI 0.51-0.70) and suffer from comorbidities such as mood disorders (OR=2.56, 95% CI 2.01-3.27), PTSD (OR=5.22, 95% CI 4.14-6.59), TBI (OR=5.00, 95% CI 1.51-16.54), or have a BMI considered obese (OR=1.89, 95% CI 1.56-2.3) (Higgins et al., 2016; Higgins et al., 2014).

Military service members are a unique population because the culture and training in addition to the comorbidities common in the military have a significant impact on how these individuals may deal with persistent pain (Denke & Barnes, 2013; Olenick et al., 2015). The culture may cause some individuals to be hesitant in seeking help and keep pushing through the pain until much later when it becomes unbearable, at which time supervisors may be skeptical of the service member's claims causing additional stress. Women in the military are especially vulnerable to push through in order to complete their mission and prevent from being ostracized or called "weak" as reported in a qualitative study (n=15) among women veterans (Denke & Barnes, 2013). This pressure can lead to hiding injuries and other health issues until service members cannot ignore them at which point they may also develop signs and symptoms of persistent pain.

Due to the struggle of managing persistent pain in the Army, General Schoomaker, the 42nd Army Surgeon General, established the Army Pain Management Task Force to address the increasing prevalence of persistent pain among military service members (Office of the Army Surgeon General Pain Management Task Force, 2010). The task force included representatives from the Army, Navy, Air Force and the Veterans

Health Administration (VHA) and found that the Military Health System (MHS) had very fragmented care. Further, there was no one specialty responsible for 'pain medicine' (Office of the Army Surgeon General Pain Management Task Force, 2010). The task force made over 100 recommendations for improvement of pain management, both acute and persistent, across the entire Department of Defense (DoD) including the development of a more comprehensive, interdisciplinary approach to treatment of persistent pain from which the intensive outpatient pain program used in this research study was born (Office of the Army Surgeon General Pain Management Task Force, 2010).

Evolution of pain theory

Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage." (International Association for the Study of Pain, 2017). The first influential pain theory was the specificity theory described by Charles Bell in 1811 (Moayedi & Davis, 2013). Bell's theory revolved around the concept of a dedicated pain pathway where each type of sensation had a specific receptor and a specific sensory fiber leading to the appropriate region of the brain. This theory, however, did not explain phenomena such as phantom limb pain in amputees or non-painful stimuli causing a painful response. In contrast, pattern theory of pain, which was proposed subsequent to specificity theory, stated that it was the pattern of the input along the same nerve fibers that resulted in pain, negating the need for multiple pathways (Moayedi & Davis, 2013). The Gate Control Theory of Pain developed by Melzack and Wall (1965) revolutionized the explanation of pain by describing an integrative model that supported and merged the ideas of the specificity and pattern theories (Moayedi & Davis, 2013). The gate control theory stated that there are

specialized nerve endings, large-diameter afferents (sensory) and small-diameter afferents (nociceptors), which synapse in the spinal cord. The input from the sensory fibers inhibits or "closes the gate" while the input from nociceptors "opens the gate" when it exceeds the input from the sensory fibers resulting in activation of the pathway that then leads to the experience of pain (Melzack & Wall, 1965). Since the theory was proposed, some critics have said the theory is oversimplified due to the lack of applicability to stimuli other than cutaneous such as the explanation of persistent pain; however, this theory has led to further advancements in research and increased understanding and treatment of pain (Sluka, 2016).

Neuromatrix theory, proposed by Melzack in 1991, evolved from the gate control theory and states that pain is produced by a neural network in the brain and not by a peripheral input such as tissue damage or another pathology (Melzack, 2001). The neural network includes somatosensory, limbic, and thalamocortical components which in turn affect the sensory-discriminative, affective-motivational, and evaluative-cognitive dimensions of the experience of pain accounting for the biopsychosocial components of pain (Melzack, 1999). The neuromatrix is predetermined genetically but is influenced by experiences such as sensory or cognitive events (Melzack, 2001). This new framework aids in explaining the complexity of pain which rarely results from a direct response to a sensory input and is determined by physiological, psychological and social factors (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). Both the gate control theory and neuromatrix theory are considered the most accurate and complementary explanations of pain to date but they are likely to evolve as researchers continue to better understand pain (McAllister, 2017b; Melzack, 1999; Sluka, 2016).

Persistent pain, most commonly described as chronic pain, is defined as pain lasting past the normal tissue healing time or pain lasting greater than three months (International Association for the Study of Pain, 2017). It has been recommended that the term 'persistent' better reflects pain lasting longer than expected and its effects on quality of one's life rather than the term 'chronic' which is often associated with a long-lasting condition that needs to be fixed or cured (Kennedy, Roll, Schraudner, Murphy, & McPherson, 2014). Due to the recommended terminology shift, the term 'persistent pain' is used in this dissertation.

Biopsychosocial Model for Understanding Persistent Pain

The biopsychosocial model is the most comprehensive approach for understanding and treating pain, especially in the case of persistent pain (Gatchel et al., 2007). Wilbert Fordyce, a clinical psychologist, determined that pain behaviors were not only a result of nociception but also the expectations based on prior experiences and learning in addition to the resulting positive or negative emotional and behavioral responses of an individual (Fordyce, 1984; Fordyce, Fowler, & DeLateur, 1968). The biopsychosocial model was first developed by Engel (1977) and described the dynamic interaction between the physiological, psychological and social components that characterized illness. The model was adapted specifically to the experience of pain. Nociception, the sensory component of pain was the physical problem in the model and pain was the resulting subjective experience (Loeser, 1980). Suffering, a negative response due to stress, anxiety or any other psychological state, and pain behavior, what the individual does or avoids doing as a response to pain and suffering, were determined

by environmental, social and cultural influences and described as the psychosocial components beyond perception of pain and nociception (Loeser, 1980) (Figure 2.1).

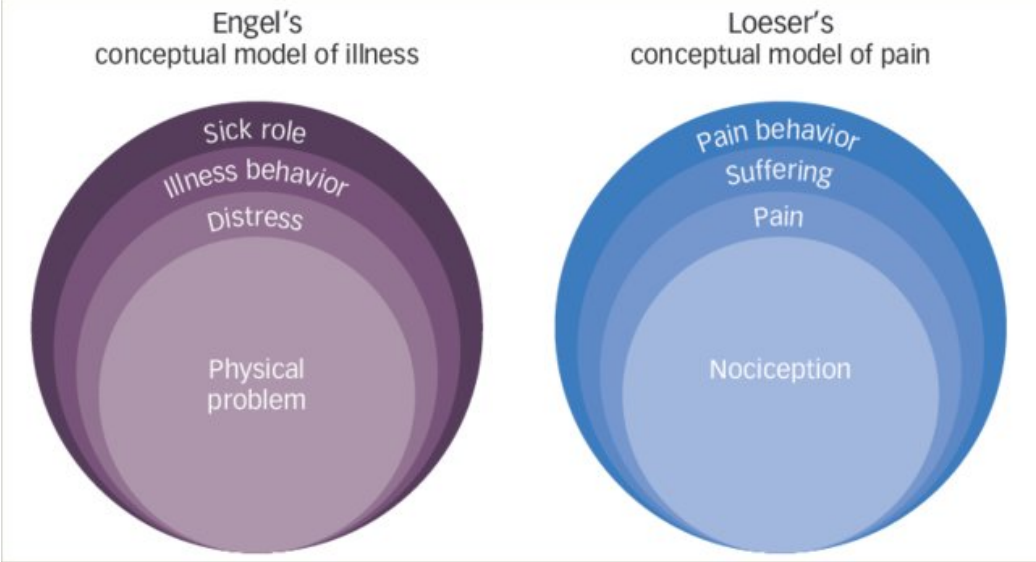

Figure 2.1 The biopsychosocial model of illness (Engel, 1977)

The biological component of the model includes the nociceptive pathway of pain which conveys information about potential or existing damage, the activation of nociceptors and ascending pathways in the central nervous system branching off to various parts of the brain including the thalamus, somatosensory cortex, and limbic system for interpretation (Khalid & Tubbs, 2017). The prefrontal cortex, cingulate and parietal cortex then determine the intensity and quality of pain while the motor cortex and brainstem activate as part of the descending modulation of pain (Khalid & Tubbs, 2017). Peripheral and central mechanisms of the nociceptive pathway can contribute to the experience of persistent pain. As healing occurs or threat is eliminated, the activation of the nociceptive pathway is expected to decrease but when it does not and there is ongoing input without presence of inflammatory mediators, resulting in peripheral sensitization

and persistent pain localized to the affected body part or area of primary hyperalgesia (Ikoma, Cevikbas, Kempkes, & Steinhoff, 2011; Spiegel et al., 2017; Woolf, 1983).

When the perceived pain extends to other areas, causing secondary hyperalgesia or emerges independently of any peripheral injury, it can no longer be explained by the peripheral mechanism but is recognized as a result of dysregulation and reactivity in the central nervous system, or central sensitization (Ikoma et al., 2011; Woolf, 1983). While hyperalgesia is a heightened level of pain to a typically painful stimulus, allodynia, also a characteristic of central sensitization, refers to a painful experience to a stimulus that is normally not painful (Lolignier, Eijkelkamp, & Wood, 2015). Allodynia may be a result of misinterpretation of input from low-threshold mechanoreceptors or resulting from decreased central inhibition of the nociceptive input (Spiegel et al., 2017). Collateral sprouting, or axonal outgrowth in the dorsal horn of the spinal cord in addition to release of tumor necrosis factor and cytokines after an injury, can cause increased nociception leading to central sensitization (Thomas Cheng, 2010). While central sensitization was thought to primarily affect the somatosensory system, in recent years, the understanding of the mechanism has expanded to include the involvement of the affective and cognitive areas of the brain which also take part in pain processing and interpretation, as described in the pain neuromatrix theory (Melzack, 2001). The anterior cingulate cortex of the brain, which modulates emotional response, demonstrated increased activity in those with persistent pain (Hsieh, Belfrage, Stone-Elander, Hansson, & Ingvar, 1995). Other areas of the brain involved in affective component of pain processing include the insula, inferior frontal gyrus, orbitofrontal cortex, ventrolateral and dorsolateral prefrontal cortex while the thalamus, insula, hippocampus, anterior cingulate cortex, dorsolateral prefrontal

cortex, and posterior parietal cortex are active in the cognitive component of pain processing (Kang, Son, & Kim, 2010). An individual's psychophysiological health can be a predisposing factor of central sensitization (McAllister, 2017a). Anxiety, depression, cognitive deficits or other psychological trauma are all conditions of the nervous system and therefore can affect central sensitization and persistent pain (McAllister, 2017a). In addition, an increasing number of studies are describing epigenetic mechanisms that make alterations in cellular activity in the brain which allow for sustainment of persistent pain (Descalzi et al., 2015). One neuroimaging study of the brain in individuals with persistent pain from hip osteoarthritis (n=32) reported a decrease in grey matter density in the anterior cingulate cortex, right insular cortex, amygdala, dorsolateral prefrontal cortex and brainstem compared to control subjects (Rodriguez-Raecke, Niemeier, Ihle, Ruether, & May, 2009). Ten of the individuals had a total hip replacement surgery resulting in pain resolution and increased grey matter in the affected areas of the brain demonstrating the plasticity and potential reversibility of changes in the brain (Rodriguez-Raecke et al., 2009). According to the neuromatrix theory, the pain matrix consists of the above-mentioned areas of the brain and is genetically predetermined but modified by lived experiences (Melzack, 2001). Diatchenko and others (2013) reported an association between genes and persistent pain conditions such as fibromyalgia but the pathophysiology and biological markers have yet to be fully explored. Nociceptive pathways were found to overlap with psychological response pathways, while disorders such as depression or anxiety were associated with genetic variation (Diatchenko et al., 2013).

Psychological and social components of pain are subjective experiences based on emotions, sociocultural influences, social support, and previous and current experiences. Psychological factors which further support the explanation of persistent pain consist of cognition and emotion (Lumley et al., 2011). Appraisal, beliefs, catastrophizing, and perceived self-efficacy are cognitive factors and depression, anxiety, anger, or other negative affect are emotional factors associated with persistent pain (Gatchel et al., 2007). A systematic review investigating the association between pain and psychological factor in persistent musculoskeletal pain reported that depression was a risk factor for pain in more body areas (RR: 6.09, CI 95% 1.1-33.5) (Reis et al., 2019). A cross-sectional study of patients with persistent pain in a Malaysian hospital (n=117) reported that an increase on the depression, anxiety and stress scores were significantly associated with higher pain scores (b=1.091, 95% CI 0.158-2.024, b=0.895, 95% CI 0.120-1.671, b=1.128, 95% CI 0.039-2.216) (Ganasegeran, 2019).

While persistent pain is mostly associated with negative psychological factors, the effect of resilience, optimism and benefit finding have been shown to improve quality of life in general, in addition to improving mental health and pain affect (Boselie, Vancleef, Smeets, & Peters, 2014; Hemington et al., 2017; West, Stewart, Foster, & Usher, 2012). A study of healthy individuals (n=68) using Quantitative Sensory Testing followed by completion of questionnaires representing negative psychological factors including depression, anxiety, pain vigilance and attention, pain catastrophizing and resilience, demonstrated that resilience was related to lower pain affect (Hemington et al., 2017). A qualitative study of 10 individuals with persistent pain found that positive psychosocial factors most often described included recognizing individual strengths and positives in

life, accepting the pain and help from others (West et al., 2012). The involvement of psychological factors in the development, perseverance and acceptance of persistent pain is further captured through various models of pain and disability described in a later section.

Social factors that may contribute to the development of persistent pain include socioeconomic status, race, gender, environmental and behavioral triggers such as personal and family history, childhood trauma or social isolation (Crofford, 2015; Janevic, McLaughlin, Heapy, Thacker, & Piette, 2017; Jones, Power, & Macfarlane, 2009; Nicholl et al., 2009). Socioeconomic status has been shown to be one of the main factors associated with persistent lower back pain in the United States (Institute of Medicine (US) Committee on Pain, 1987; Johannes, Le, Zhou, Johnston, & Dworkin, 2010). A study using an internet-based survey (n=27,035) found increased likelihood of persistent pain in low income households (OR: 1.45, 95% CI, 1.30-1.61) and among those who were unemployed (OR: 1.90, 95% CI, 1.75-2.06); prevalence of persistent pain was also higher among females (34.3%) compared to males (26.7%) (Johannes et al., 2010). A study surveying patients who were being treated in a multidisciplinary pain center (n=3,730) found that Black race and lower neighborhood socioeconomic status were associated with increased affective pain and pain-related disability (Green & Hart-Johnson, 2012). The National Health Interview Survey reported that individuals with less than high school education were more likely to report persistent back pain as were those with lower occupational status and wealth which is consistent with lower education level; women were twice as likely to experience persistent pain and Black, White, American Indian, and Alaska Native adults were more likely to experience persistent pain than

Asian adults (Department of Health and Human Services Report, 2011). A British Birth Cohort Study (n=7,571) surveyed individuals at 45 years old and reported a significant increase in the risk of developing persistent pain as adults if when they were children the individuals were: hospitalized due to a road traffic accident (RR: 1.5; 95% CI: 1.05-2.1); lived in institutional care (RR: 1.7; 95% CI: 1.3-2.4); experienced the death of their mother (RR: 2.0; 95% CI 1.08-3.7); and experienced financial hardship (RR: 1.6: 95% CI: 1.3-1.9) (Jones et al., 2009).

Behavioral factors such as sleep disturbances, smoking, or obesity have also been shown to contribute to the occurrence of persistent pain. Research on consequences of sleep disturbances on health and quality of life, has been gaining attention in recent years. The HUNT study in Norwegian population (n=28,367) reported that individuals with sleeping problems had increased odds of persistent widespread pain (OR: 1.49, 95% CI 1.30-1.71) as well as former smokers (OR: 1.23, 95% CI 1.05-1.45) compared to never smokers, and individuals considered obese (OR: 1.68, 95% CI 1.39-2.02) compared to those with normal weight (Mundal, Grawe, Bjorngaard, Linaker, & Fors, 2014). The Netherlands Study of Depression and Anxiety (n=1,860) found that insomnia and short sleep were associated with increased risk of onset of new persistent pain with Hazard Ratios: 1.60, 95% CI 1.30-1.96, and 1.52, 95% CI 1.22-1.90, respectively (Generaal, Vogelzangs, Penninx, & Dekker, 2017). Another study of individuals in mid- to later-life (n=948) in the United States found that the greater sleep disturbance and shorter sleep time predicted greater levels of pain interference (b=0.69, p<.001, b= -0.018, p<.001, respectively) (Ravyts, Dzierzewski, Raldiris, & Perez, 2018).

Models of Pain and Disability

Several models of pain and disability have been described. Linton and Shaw (2006) and Main (2013) discuss eight models which highlight the importance of psychological factors contributing to persistent pain and how these factors create disability in those who suffer from it.

The *fear-avoidance model* indicates that if someone experiences a painful event to be threatening and continues to ruminate on this experience, the individual will develop pain-related fear (Gatchel, Neblett, Kishino, & Ray, 2016; D. C. Turk & Wilson, 2010). The negative reactions lead to catastrophizing, increased awareness of any pain sensations experienced and avoidance of physical and social activities resulting in withdrawal, depression and self-perceived disability as demonstrated in figure 2.2 (Gatchel et al., 2016; D. C. Turk & Wilson, 2010).

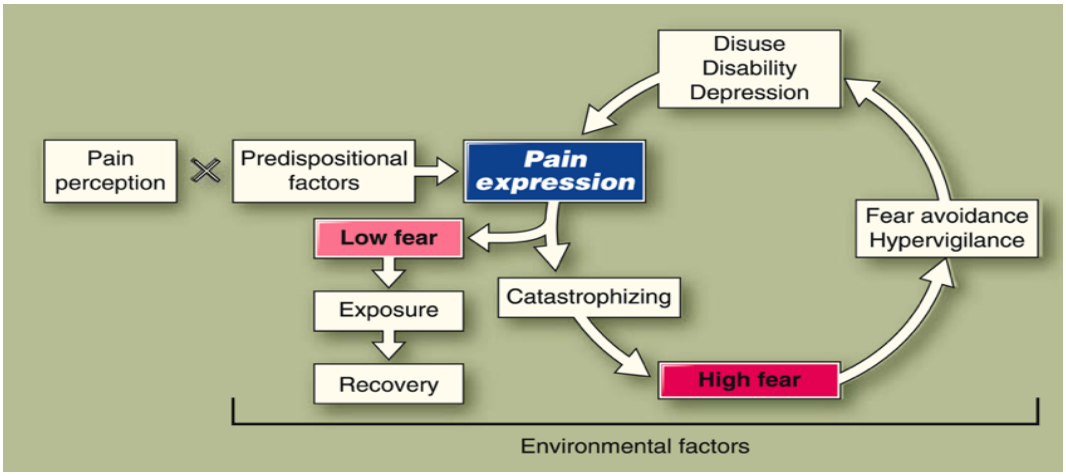

Figure 2.2. Fear-avoidance model of pain. (D. C. Turk & Wilson, 2010)

Questionnaires such as the Tampa Scale for Kinesiophobia (TSK) or the Fear-Avoidance Beliefs Questionnaire (FABQ) have been used to demonstrate that pain-related behavior

is more directly associated with perceived disability than pain or any underlying pathology supporting this cognitive-behavioral model of fear of movement and reinjury (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Gatchel et al., 2016; Vlaeyen JW, 1995).

The *acceptance and commitment model*, which is commonly used in various psychotherapy treatments, is grounded in changing one's individual relationship with pain in order to prevent it from controlling one's life (Hayes, Pistorello, & Levin, 2012). Realistic expectations and behavior change that focus on participation in valuable and goal-progressing activities, will help decrease the effect of pain on quality of life and function (Linton & Shaw, 2011).

Misdirected problem-solving in persistent pain, described by Eccleston and Crombez (2007), illustrates individuals who frame their pain in biomedical terms only which leads to the belief that pain relief and fixing the physiologic problem are the only solutions. When there is no pain relief, worrying, anxiety and fear continue as well as an ongoing search for solutions to the biomedical problem. According to this model, the problem itself has to be reframed and not thought of as a biomedical issue in order to be solved (Eccleston & Crombez, 2007).

The *self-efficacy model* has been applied to various health-related conditions and is applicable to persistent pain. Self-efficacy is defined as the confidence to plan and execute an activity and reach a desired outcome (Bandura, 1977). Individuals with high self-efficacy, reach a greater understanding of pain in order to be able to self-manage their symptoms, seek care and resources appropriately, and function successfully and confidently (Linton & Shaw, 2011). In contrast, those with low self-efficacy tend to

believe they do not have control over their pain and are unable to manage it themselves. They are more likely to seek out biomedical solutions to their pain rather than self-management strategies (Linton & Shaw, 2011).

The *stress-diathesis model* illustrates that increased stress, anxiety and other worries in one's life can worsen the experience of persistent pain because resources and strategies for managing are being used elsewhere (Linton & Shaw, 2011). Waddell's (2010) extensive research of psychosomatic symptoms as they relate to back pain and subsequent disability can be applied to any persistent pain, based on this model. Whether it is depression, stressful family and work situations or other major life events, the emotional response can intensify the experience of persistent pain (Walter, Leissner, Jerg-Bretzke, Hrabal, & Traue, 2010). Therefore, the addition of context, including lifestyle and any stressful past and present experiences, are required to better understand pain. The cycles of fear-avoidance, lack of acceptance and low self-efficacy need to be addressed by patients and their healthcare providers in order to effectively manage persistent pain.

Main (2013) discusses three additional models of pain and disability including *emotional process-pain model, pre-dispositional model,* and *avoidance-endurance model*. In the first model, there is an interdependence of emotional processing and pain. Negative emotions are processed in the same parts of the brain as pain and when there is dysregulation or maladaptive emotional processing, it leads to persistent pain (Main, 2013; Walter et al., 2010). As with the other models, most effective pain management should include psychologically-oriented treatment.

The pre-dispositional model takes into account psychological factors, characteristics and personality traits that are already present in individuals and which may contribute to persistent pain development (Main, 2013). These may include fear, increased overall anxiety, and anxiety due to pain or uncertainty (Carleton, 2012). The factors in this model overlap with those of the other models of pain and disability focusing on the influence of the psychological factors in persistent pain.

The avoidance-endurance model describes a distress and a eustress response to pain. Distress or persistence of negative behaviors and emotions creates a maladaptive coping behavior while a eustress pattern leads to suppressing negative pain experiences resulting in adaptive coping (Main, 2013). Identifying these models of pain and disability in individuals with persistent pain helps better understand one's pain experience and simultaneously can guide the appropriate treatment.

Persistent Pain as a Disease or Symptom

Recent advances in neuroimaging have led to creating a stronger argument for persistent pain to be labeled as a disease process rather than a group of symptoms. Researchers have found that persistent pain has an effect on the brain just as other neurological or psychiatric disorders, causing reduced deactivation of certain parts of the cortical region, altering of the descending inhibition and facilitation systems, and structural changes of the thalamus and gray matter (Baliki, Geha, Apkarian, & Chialvo, 2008; Tracey & Bushnell, 2009). A study comparing 26 subjects with persistent lower back pain to matched controls found that those with persistent pain had 5-11% less neocortical gray matter, the amount lost during 10-20 years of normal aging (Apkarian et

al., 2004). These findings are consistent with the definition of a disease, which is a disorder of a structure or functioning system in the body, rather than a set of symptoms that can be ambiguous and subjective.

There is an ongoing lack of consensus on whether persistent pain should be considered a disease or an illness. The views are divided because it has been difficult to establish whether the structural, functional and chemical changes that take place in the brain cause persistent pain or are a response of the brain adapting to pain (Tracey & Bushnell, 2009). The supporters of labeling persistent pain as a disease indicate that persistent pain has its own pathology with alterations in sensory pathways, mood and social disruptions (Raffaeli & Arnaudo, 2017; Siddall & Cousins, 2004). Those who oppose defining persistent pain as a disease suggest that it creates a faulty circular argument that states pain is a causative factor of a disease called 'pain' (Cohen, Quintner, & Buchanan, 2013). Lastly, a view that pain is a disease and a symptom has also been presented because while acute pain acts more like a symptom and persistent pain acts more like a disease, there is no clear demarcation between the two therefore it should be treated as both (George, 2017).

Patient Persistent Pain Experience

Individuals who suffer from persistent pain often become frustrated when asked to quantify their pain in some way because of the widespread nature of their symptoms and inability to select a single response that adequately describes what they are feeling (Robinson-Papp, George, Dorfman, & Simpson, 2015). The struggle to maintain identity, explain and prove credibility of pain, negotiate the health system and move forward with

the pain were themes conceptualized as most often recurring in individuals with chronic musculoskeletal persistent pain suggesting that the psychosocial component of pain is a key factor in a patient's experience (Osborn & Rodham, 2010; Toye et al., 2013). Based on qualitative research, an individual with persistent pain is able to move forward with persistent pain, when he or she is able to redefine what normal is, accept and have the ability and knowledge to speak about pain, and find a community that can be part of their social support (Toye et al., 2013). This analysis supported the idea of interdisciplinary management for persistent pain because the many aspects of the struggle and coming to terms with the pain require involvement of various specialists and support groups. Interdisciplinary management of persistent pain has been shown to be effective in improving self-management and decreasing health care utilization which will be further discussed in the treatment section later in this chapter (D. D. McGeary et al., 2012; Toye et al., 2013).

Pietila-Holmner and others (2017) found that increased knowledge and understanding of the complexity of pain and the relationship and collaboration with health care providers were essential in patients' acceptance of and living with pain. Nurse case managers in an interdisciplinary pain program were considered emotional and motivational supporters, not only managers who helped navigate the healthcare system (Matthias, Miech, Myers, Sargent, & Bair, 2012a). This suggests that a strong alliance with healthcare providers was fundamental in helping patients with persistent pain become motivated and activated to be managers of their own health. This evidence is consistent with findings reported on positive therapeutic alliance between patients and their physical therapists which was associated with improvements in persistent back pain

(Ferreira et al., 2013). Capturing one's knowledge, self-management skill, confidence and presence of social support, that are essential components of pain, is difficult because quantitative measures are not able to fully demonstrate the pain experience.

Pain Assessment

Development of objective and reliable measures for persistent pain has been challenging due to the complexity and subjective experience of pain. Heavy reliance on patient reported symptoms, which can vary tremendously from patient to patient and from time to time, make it extremely difficult to assess everyone with the same tools (Salaffi et al., 2015). An individual's pain response is based on current and previous experiences, including sensory, emotional, sociocultural, behavioral and cognitive dimensions, complicating one's response (Crofford, 2015; Hopper, Curtis, Hodge, & Simm, 2016).

Persistent pain is rarely associated with one type of pain, tissue impairment or area of the body; it is most often a cluster of symptoms, and is not consistent in every individual with persistent pain even with a similar diagnosis (International Association for the Study of Pain, 2017). Due to the prevalence of persistent pain, the American Pain Society advocated for pain level to become the 'fifth vital sign' recorded during medical visits in hopes to increase detection and improve management of pain (Campbell, 1996). However, often patients do not believe that their pain can be accurately measured, they do not have a good understanding of the intensity scale and have difficulty assigning a number to what they are experiencing (Robinson-Papp et al., 2015). The increase in pain assessment and documentation by health care providers did not improve the quality of

pain management or patient satisfaction as was anticipated (Mularski et al., 2006). On the contrary, it has been suggested that the emphasis on unidimensional pain intensity reporting has contributed to the opioid epidemic in the U.S. because prescribing opioids became a quick solution to address pain due to requirements placed on providers (Levy, Sturgess, & Mills, 2018; Scher, Meador, Van Cleave, & Reid, 2018; Tompkins, Hobelmann, & Compton, 2017; Topham & Drew, 2017).

In individuals with persistent pain, intensity is only part of the experience and may not be as important as psychosocial components such as anxiety, catastrophizing, or social support in how the disability and manifestation of persistent pain is perceived (Sullivan & Ballantyne, 2016). Successful treatment programs for persistent pain tend to meaningfully improve quality of life and decrease the perception of disability, with a much smaller effect on pain intensity, averaging a 33% decrease in pain intensity ratings (Hubbard, Tracy, Morgan, & McKinney, 1996). This suggests that using intensity scales such as the Visual Analog Scale (VAS) or the Numeric Pain Rating Scale (NPRS) alone in assessment of persistent pain may not have been sufficient and measurement of the other components is necessary for a holistic assessment (Salaffi et al., 2015).

It is proposed that a complete assessment of persistent pain should include a multidimensional pain measurement in addition to assessment of the biopsychosocial components of pain and quality of life (Salaffi et al., 2015). A multidimensional pain scale, such as the commonly used McGill Pain Questionnaire, not only includes an intensity rating, but also the location on a diagram, quality, and levels of interference with various activities (Melzack, 1975). Specific assessments of physical function, cognitive, behavioral and emotional factors including sleep quality, coping strategies,

healthy or unhealthy behaviors, and expectations will result in a comprehensive assessment of persistent pain (Dennis C. Turk et al., 2016).

Assessing Outcomes in Intensive Pain Management Programs

Intensive pain management programs use a variety of quantitative measures to assess changes in pain, function and quality of life. Visual analog scale (VAS) or the Numeric Pain Rating Scale (NPRS) continue to be used but are never used in isolation (Salaffi et al., 2015). Most commonly and frequently used additional outcome measures, summarized in table 2.1, include pain inventories (Brief Pain Inventory); pain related attitudes, beliefs and fear assessment (Pain Catastrophizing Scale, Pain Self-Efficacy Scale, Tampa Scale for Kinesiophobia); quality of life measure (Nottingham Health Profile, Short Form-36); specific body region disability questionnaire (Neck Disability Index, Roland-Morris Disability Questionnaire); and a variety of physical function assessments which may involve a questionnaire (Functional Independence Measure) or actual physical function testing (Gatchel et al., 2009; Pujol et al., 2015; Dennis C. Turk et al., 2016; Younger et al., 2009). Additional outcome measures, acquired from medical record reviews, may also include health care utilization after the program, pain medication use and return to work, military or other duties (Gatchel et al., 2009; Hubbard et al., 1996; D. D. McGeary et al., 2013; D. D. McGeary et al., 2012; Peters, Simon, Folen, Umphress, & Lagana, 2000). Participation in intensive pain management programs was observed to have more subjective impact rather than measurable outcomes including knowledge and skills gained to understand and manage pain (Matthias, Miech, Myers, Sargent, & Bair, 2012b).

Table 2.1 Outcome measures used in pain management program assessment

Type of Measure	*Examples*
Pain Inventory	Brief Pain Inventory
Pain related attitudes, beliefs and fear	Pain Catastrophizing Scale, Pain Self-Efficacy Scale, Tampa Scale for Kinesiophobia
Quality of Life	Nottingham Health Profile, Short Form-36
Specific body region disability questionnaire	Neck Disability Index, Roland-Morris Disability Questionnaire, Oswestry Disability Index
Physical Function	Functional Independence Measure
Physical Assessment	Varied fitness and functional testing
Other	Healthcare utilization, medication use, return to work/military duty

A qualitative study in veterans demonstrated that persistent pain intensity does not consistently decrease even with interdisciplinary intervention but program outcomes are considered successful by participants and providers when the confidence in the ability to self-manage, cope with, and accept pain, improves with the interventions (Matthias, Kukla, McGuire, & Bair, 2016; Matthias et al., 2012a, 2012b). A recent qualitative study in veterans assessed patient outcomes, barriers and facilitators for sustaining improvement after completion of an interdisciplinary intervention and found a spectrum of patient experience from those who were unmoved by the intervention to those whose whole life changed providing a perspective into the experiences of those with persistent pain that is often not captured by quantitative studies (Penney & Haro, 2019). While multidimensional assessment of persistent pain has substantially improved the understanding of the individual pain experience, the process of change and full impact of

an intervention on one's experience of pain may not be fully reflected in the questionnaires used.

Qualitative methods, although uncommon and more burdensome on patients and providers, may explore the depth of benefit or lack of benefit, differences between responders and non-responders that are expected, unexpected or unmeasurable quantitatively. Patient narrative and observed behavior during a treatment program like the intensive outpatient pain program warrants further research and may provide added contextual information to inform the process of change in individuals participating in the intervention. It may also assist with developing and revising the intervention further, resulting in increased support for interdisciplinary program as an effective treatment for persistent pain.

Ecological Momentary Assessment of Persistent Pain

Ecological Momentary Assessment (EMA) is not one single research method and involves repetitive sampling of experiences or behaviors in real-time, in a natural environment (Shiffman et al., 2008). Various techniques are used for EMA and may include paper diaries, electronic diaries, internet-based electronic surveys and most recently, smartphone applications where the technologically advanced methods may help increase compliance by setting reminders which can prompt participants to respond at a given time (Garcia-Palacios et al., 2014; Shiffman et al., 2008). As of 2018, 77% of American use smartphones therefore EMA studies using phone apps can be extremely convenient way to answer survey questions with prompting without adding significant burden for an individual (Pew Research Center, 2018; Runyan & Steinke, 2015).

EMA can help to assess changes over time, within person changes or contextual associations more accurately than other methods (Bolger, Davis, & Rafaeli, 2003). Assessment of pain, psychological status or any other symptoms in the 'here and now' can improve the reliability of the information provided and reduce recall bias which is often determined by how the experience was remembered and encoded by the individual based on emotion or affect and how they are feeling at the time of response (Stone, Broderick, Shiffman, & Schwartz, 2004; Van den Bergh & Walentynowicz, 2016). EMA, in its various forms, has been used effectively in assessing pain, fatigue, and other symptoms in musculoskeletal conditions (lower back pain), neurological conditions (multiple sclerosis), psychological conditions (depression) and various other chronic conditions (Axen & Bodin, 2016; Garcia-Palacios et al., 2014; Iacob et al., 2016; Kratz et al., 2017). EMA with the use of a smartphone application for daily monitoring of persistent pain was found to have a compliance rate of 75.7% and moderate-to-strong correlations (r=0.38-0.99) between the app and traditional measures that used recall to document symptoms (Suso-Ribera et al., 2018).

EMA can be a reliable method to track temporal changes and contextual associations in various settings but has not been utilized while individuals participate in an interdisciplinary intensive pain management program. Daily assessments can provide a more comprehensive, multidimensional assessment of the evolution of pain and facilitate a deeper understanding of the participants' experience in intensive outpatient programs, rather than simply comparing pre and post intervention measurements. Improved knowledge of symptom patterns throughout the treatment program could

provide a novel method to monitor patient progress and refine the program including the timing and dosage of various intervention components to maximize treatment outcomes.

Biomedical Treatment for Persistent Pain

The biomedical model for treatment of pain focuses on the neurophysiological or biomechanical causes and assumes that a structural or functional problem such as tissue damage needs to be identified and then treated accordingly with medication, or other techniques which may include active or passive methods (Sluka, 2016). In this model, health care providers are expected to perform a treatment or prescribe medication in order to eliminate pain and 'fix' the problem. This approach oversimplifies the experience of pain in an attempt to produce an observable explanation without taking into account the psychosocial context that is different in every individual (Bendelow, 2013). The isolated biomedical model is especially not adequate in the case of persistent pain as evidenced by the lack of long-term effectiveness in pain reduction or changes in any other symptoms. One study found that long-term opioid therapy had no significant effect on reduction of pain, depression symptoms and sleep function but sexual functioning significantly worsened over time (Morasco et al., 2019).

Aside from medications, other common biomedical treatments include injections, spinal cord stimulators or surgeries for chronic conditions such as refractive back pain or arthritis (Aiudi et al., 2017; Hedlund, Johansson, Hagg, Fritzell, & Tullberg, 2016; Shreibati & Baker, 2011). As people age, degenerative changes in the spine including arthritis, disc disease or osteoarthritis in peripheral joints are expected and in a large part of the population are asymptomatic (Boden, Davis, Dina, Patronas, & Wiesel, 1990;

Brinjikji et al., 2015). However, those who do have spine or joint pain often look for legitimization of their symptoms with structural causes. When abnormalities are discovered on imaging, they fixate on the findings as the problem that needs to be addressed, not taking into consideration whether the symptoms are consistent with the findings and whether other psychosocial issues may be present. Imaging can have a counterproductive effect leading to fear-avoidance and catastrophizing behaviors due to findings (T. W. Flynn, Smith, & Chou, 2011). Healthcare providers are often quick to order imaging to quickly provide an observable explanation for the symptoms and improve patient satisfaction (Kendrick et al., 2001). Increased use of spine imaging over the last 25 years has led to increased utilization of surgeries for these structural changes and non-specific back pain, significantly increasing healthcare costs and risk of complications, all without clear indications or improvement of symptoms (Deyo, Gray, Kreuter, Mirza, & Martin, 2005; T. W. Flynn et al., 2011). Researchers have shown that in the long-term, spinal surgery such as fusion for persistent low back pain is no better than non-operative treatment such as exercise or cognitive-behavioral therapy, suggesting non-operative interventions, which offer less complications or potential side effects should be utilized prior to more invasive treatments (Brox et al., 2003; Hedlund et al., 2016; Mannion, Brox, & Fairbank, 2016; Mirza & Deyo, 2007).

Spinal cord and various peripheral nerve stimulators have also been used for treating persistent back pain and have demonstrated benefits in decreasing pain (Ishak, Campos, Brunn, Unterberg, & Ahmadi, 2017; Liem et al., 2015; Song, Popescu, & Bell, 2014). However, these interventions, many of which are invasive, can produce complications and have shown loss of effectiveness in the long-term with patients

reporting a significant increase in pain within two years of the procedure leading to removal, replacement or another intervention that may have been required (Aiudi et al., 2017). A study found that on average, 34% of those who had a stimulator implanted, had adverse events including superficial or deep infection, equipment failure or pain where the stimulator was located (Turner, Loeser, Deyo, & Sanders, 2004). Other devices such as intrathecal drug delivery systems, also used for treatment of persistent pain, can cause increased morbidity and mortality due to the risk of complications such as infection (2-5%), cerebrospinal fluid leak (20%) or mechanical complications (10.5%) among others (Abrecht, Greenberg, Song, Urman, & Rathmell, 2017; Bottros & Christo, 2014). These devices require close monitoring which can escalate the cost of this treatment not counting any potential issues that arise which may cause the need for removal of the device and treatment of the side effects (Bolash et al., 2015).

Due to the increased awareness of the limited effectiveness of various biomedical treatments for pain, patients and providers are seeking alternate interventions to manage pain without the use of medications and other invasive procedures leading to interdisciplinary pain management programs as a feasible choice.

Psychological Treatment for Persistent Pain

Cognitive behavioral therapy (CBT) is one of the most commonly used and empirically supported psychological interventions for persistent pain conditions (Ehde, Dillworth, & Turner, 2014; Fisher, Law, Palermo, & Eccleston, 2015; Pike, Hearn, & Williams, 2016; Sveinsdottir, Eriksen, & Reme, 2012; Williams, Eccleston, & Morley, 2012). According to the Institute of Cognitive Behavior Therapy, CBT is based on a

cognitive model and is a "structured, present-oriented psychotherapy directed toward solving current problems and teaching clients skills to modify dysfunctional thinking and behavior" (Beck Institute for Cognitive Behavior Therapy, 2016). CBT can vary in the number of sessions, their duration and can include various techniques such as cognitive restructuring, behavioral experiments, setting goals, relaxation training, activity pacing and problem-solving training (Ehde et al., 2014; Sveinsdottir et al., 2012). CBT does not have to be administered by a psychologist; it is often used by other, trained health care professionals in individual or group settings or as it is becoming increasingly popular and cost-effective, virtually over the internet (iCBT) (Worm-Smeitink et al., 2019; Xiang et al., 2019). One study found that iCBT had moderate effects on anxiety (*SDM*=0.64, *p*=.01), depression (*SDM*=0.64, *p*=.001), and pain severity (*SDM*=0.41, *p*=.003) in a population with persistent pain (Mehta, Peynenburg, & Hadjistavropoulos, 2019).

Sveinsdottir et al. (2012) revealed in a systematic review of CBT for persistent lower back pain that CBT alone, regardless of the structure, setting or duration of the therapy, showed greater improvements in pain control, coping and activity tolerance while decreasing negative pain behaviors such as catastrophizing, as compared to wait list controls, various physical therapy treatments, education, and invasive procedures such as spinal fusion surgery. Long-term follow ups, up to 5 years, reported sustained results in continued quality of life and decreased economic consequences such as less risk of sick leave or health care utilization compared to other treatments (Sveinsdottir et al., 2012). A meta-analysis of psychological treatments for fibromyalgia demonstrated that CBT was superior to other psychological treatments in short-term pain reduction (Hedges's g=0.60, 95% CI: 0.46-0.76) while reduction in other symptoms such as sleep

problems (Hedges's g=0.46, 95% CI: 0.28-0.64), depression (Hedges's g=0.33, 95% CI: 0.20-0.45), or catastrophizing (Hedges's g=0.33, 95% CI: 0.17-0.49) were effective with any of the psychological treatments (Glombiewski et al., 2010).

Despite its effectiveness in managing persistent pain, cognitive behavioral therapy continues to carry a level of stigma among some populations including the military. Despite the attempt by the military to dispel these myths, the common misconception among service members is that seeking behavioral health treatment leads to being viewed differently by leadership and peers and for some, even more importantly, the possibility of rejection from a sought out job opportunity (Ben-Zeev, Corrigan, Britt, & Langford, 2012; Green-Shortridge, 2007; Sharp et al., 2015). Psychological treatment is not frequently recommended by primary care providers as first line of care for pain but often when all other options have been exhausted. Patients are more likely to accept CBT as part of their treatment when recommended by a health care provider with whom they have an established relationship (Maiers, Westrom, Legendre, & Bronfort, 2010). Individuals with persistent pain tend to consider CBT alone as less helpful and irrelevant to their pain, but when combined with another form of treatment including physical therapy or exercise education, they are more likely to accept it as a positive and useful intervention (Bee, McBeth, MacFarlane, & Lovell, 2016). Gaining insight into the process of acceptance of this treatment component for persistent pain warrants further investigation. Interdisciplinary intensive treatment program provides a practical setting for an inquiry into a process of change while receiving an intervention.

Complementary Therapies

Complementary therapies are various therapies or interventions that are not considered conventional medicine such as acupuncture, massage, chiropractic care, meditation, yoga, or tai chi (Tan et al., 2007). Use of some type of complementary therapy or medicine was reported by 40% of those with persistent pain and by 33.2% of Americans overall (Clarke TC, Black LI, Stussman BJ, Barnes PM, & RL, 2015; Konvicka, Meyer, McDavid, & Roberson, 2008). Another study found that two-thirds of participants with persistent pain used at least one type of complementary therapy with massage (60%) and acupuncture (56%) most commonly used (Ossendorf et al., 2009). More than 60% of cancer centers in the United States provide information about complementary therapies to help patients deal with pain, in many cases persistent, because patients are not satisfied with conventional treatments (Yun et al., 2017). Among veterans, 27% used some type of complementary therapy for persistent musculoskeletal pain with most frequent use of meditation (15%), yoga (7%), and acupuncture (6%) (Taylor et al., 2019). Individuals with persistent pain tend to seek out complementary therapies when conventional methods such as medications or interventional pain medicine are exhausted and because complementary methods are seen as 'natural,' therefore considered safer with less side-effects or complications (Konvicka et al., 2008).

Yoga has become increasingly popular in recent years as a form of exercise for general health and wellness and it is also more frequently recommended for individuals with persistent pain to help manage symptoms while continuing to stay active (Cramer, Lauche, Haller, & Dobos, 2013). Systematic reviews and meta-analyses have shown evidence for yoga intervention in persistent neck and lower back pain (Li, Li, Jiang, &

Yuan, 2019; Wieland et al., 2017). Yoga was shown to be effective in decreasing neck pain (*SMD*= -1.13, *p*<.001) and neck pain-related functional disability (*SMD*=-0.92, *p*<.001), improving quality of life (*MD*=3.46, *p*=.01), and mood (*SMD*= -0.61, p<.001) (Li et al., 2019). For persistent lower back pain, there was low to moderate evidence for yoga over non-exercise on functional status at 1-2 months (*SMD*=-0.45), at 6 months (*SMD*= -0.44), and at 12 months (*SMD*=-0.26) (Wieland et al., 2017). A randomized noninferiority trial comparing 12 weeks of weekly yoga class, 15 individual physical therapy sessions and educational book demonstrated that yoga was noninferior to physical therapy or education and both yoga and physical therapy were more likely to have clinically significant outcomes on the Roland-Morris Disability Questionnaire compared to education and reported a 21% and 22% decrease in medication use, respectively (Saper et al., 2017).

Few studies on yoga have been done within the military population. A recent literature review of research on yoga in military populations with persistent pain yielded a small number of studies with promising, positive effects mainly among veterans, to include decreased pain, anxiety, opioid medication use and improved sleeping patterns (Miller et al., 2017). A RCT involving military veterans (n=150) consisted of 12 weeks of twice-weekly yoga sessions with randomization into yoga or delayed yoga group (Groessl et al., 2017). The study demonstrated a significant difference on the Roland-Morris Disability Questionnaire (*MD*= -2.48, *p*=.003) and pain intensity (*MD*= -0.59, *p*=.013) at 6-months, while the immediate results after 12 weeks were only significantly different between groups for pain intensity (*MD*= -0.65, *p*=.005) (Groessl et al., 2017). Many veteran organizations, like the Wounded Warrior Project, partner with yoga studios

to offer free or discounted classes for veterans (Wounded Warrior Project, 2016). A study is currently underway to determine effectiveness of yoga in veterans with persistent lower back pain and other psychological comorbidities compared to education with a self-care book (Saper et al., 2016).

Other complementary therapies may include acupuncture, massage therapy, chiropractic treatment and various forms of exercise and physical activity (Clarke TC et al., 2015; Yun et al., 2017). A review of complementary therapies found various levels of effectiveness in managing persistent pain with strongest evidence for acupuncture and low to moderate evidence for yoga, relaxation and massage (Y. C. Lin et al., 2017). Even with the lack of strong evidence, people with persistent pain are increasingly turning to complementary treatment and management strategies as these are being acknowledged by healthcare providers and included as part of interdisciplinary pain management.

Exercise-Based Treatment

The effectiveness of physical exercise-based programs for persistent pain have been studied, most commonly in patients with fibromyalgia, osteoarthritis or other various musculoskeletal pain conditions (Geneen et al., 2017). A Cochrane review addressed physical activity and exercise for persistent pain including studies that implemented any exercise therapy such as: aquatic therapy, range of motion and flexibility exercise, aerobic exercise, strength/resistance exercise, motor control exercise, balance exercise, tai chi, yoga, and Pilates (Geneen et al., 2017). The review did not find consistent results in self-reported pain scores, however, physical function improved significantly with small effect size in 8 studies, moderate effect size in 3 studies and large

effect size in 1 study (*SMD*= 1.10). The results were positive for psychological function (mental health, depression, anxiety) and quality of life with small to moderate effect sizes (*SMD*= 0.2-0.8) (Geneen et al., 2017). From the studies that informed on possible harm, no harm was reported no matter what form of exercise was used which demonstrates that activity, in general, is acceptable and effective in those with persistent pain (Geneen et al., 2017).

Interdisciplinary Pain Management Treatment for Persistent Pain

Integrative health care approaches for persistent pain including interdisciplinary outpatient programs, have been present in the United States in various forms since the 1940s when the initial interdisciplinary pain treatment teams were formed (Schatman, 2007). In the last 20 years, interdisciplinary programs have gained interest due to increasing prevalence of persistent pain, ineffectiveness of current standards of care, identification of the opioid crisis, and an improved understanding of biopsychosocial treatment for persistent pain (Schatman, 2007; Sullivan & Ballantyne, 2016; Toblin et al., 2014).

A variety of interdisciplinary programs exist lasting from several weeks to several months and include a variety of disciplines (Scascighini, Toma, Dober-Spielmann, & Sprott, 2008). They can be part-time, full-time, inpatient or outpatient and just as they vary in duration, they also vary in content and type of providers who work together as part of this program including physiatrists, physical and occupational therapists, clinical psychologists, nurses and dietitians (Singh, Küçükdeveci, Grabljevec, & Gray, 2018). One specific type of interdisciplinary programs which has shown to be effective is an

Intensive Outpatient Program (IOP) offered at many pain management centers across the United States and within the Military Health System (MHS) (Stanos, 2012). The program can range from 3 to 6 weeks and focuses on the biopsychosocial factors that affect persistent pain, typically including individual and group therapy, medication management, psychosocial education, functional training, physical therapy or some form of graded exercise program, and other complementary therapies including acupuncture or yoga (Gardea & Gatchel, 2000). The military IOP, used in this research study, will be described in greater detail below and in Chapter 3 in the Setting section of Methodology.

Individuals who completed interdisciplinary treatment programs were found to have increased coping skills to self-manage their persistent pain, decreased fear of pain and re-injury, decreased pain catastrophizing, improved physical and psychological functioning and overall quality of life. IOP proved to be more effective than standard treatment demonstrated in a RCT (n=66) by moderate to large effect sizes as summarized in table 2.2 (Gatchel & Okifuji, 2006; D. D. McGeary et al., 2016). The effects were also determined to have lasting effects at 6 months, with opioid use reported by 18% of the interdisciplinary treatment participants compared to 52% of those who received standard care (Gatchel et al., 2009; D. D. McGeary et al., 2013; D. D. McGeary et al., 2012). At the one-year follow-up health care utilization had decreased significantly among the interdisciplinary treatment group while the standard treatment group had four times as many medical visits (Gatchel et al., 2009). As part of the same study, McGeary and others (2016) found that comorbidities such as depression and PTSD did not significantly affect the outcome of the interdisciplinary treatment program, suggesting that it may not

be necessary to specifically or individually address those psychiatric symptoms in addition to the comprehensive program already established.

Table 2.2. Comparison of effect sizes by outcome measures in standard treatment vs. 3-week outpatient interdisciplinary treatment for persistent pain (n=66). (Gatchel et al., 2009)

Outcome measure	Interdisciplinary treatment (n=30)	Standard treatment (n=36)
	Cohen's *d*	Cohen's *d*
Pain Visual Analog Scale	1.04	0.05
Pain Disability Questionnaire	0.97	0.12
Beck Depression Inventory	0.90	0.37
SF-36 Physical	1.21	0.16
SF-36 Mental	0.25	0.27
MPI – Interference	0.70	0.32
MPI – Affective Distress	0.55	0.35
Oswestry Disability Index	0.99	0.21
FABQ-PA	1.57	0.13

Notes: SF-36 - Short-Form 36; MPI - Multidimensional Pain Inventory; FABQ-PA – Fear-Avoidance Beliefs Questionnaire – Physical Activity.

Murphy, Phillips, and Rafie (2016) at the Veteran's Hospital in Tampa, Florida, demonstrated improvements across all domains including pain intensity, pain-related fear, sleep and pain catastrophizing in participants of a 3-week inpatient intensive pain program (n=324). Effect sizes are summarized in table 2.3. Sex differences were reported, with females making more significant improvements in pain intensity (*d*=0.49 v. *d*=0.39) and sleep (*d*=0.84 v. d=0.45) when measured immediately after the program, but those improvements were not sustained at the 3-month follow-up, while males continued to maintain the gains they made during the program (Murphy et al., 2016).

A more recent study completed in a Canadian population with persistent pain (n=129), reported small to large effect sizes for decreasing fear of movement and reinjury (*d*=0.38), pain catastrophizing (*d*=0.29), wellness-focused coping (*d*=0.61), and pain self-efficacy (*d*=0.44) after an 8-week interdisciplinary pain management program (Table 2.4) (Katz et al., 2019).

Table 2.3. Effect sizes by outcome measures of a 3-week inpatient interdisciplinary pain management program (n=324). (Murphy et al., 2016)

Outcome measure	Female (n=67) Cohen's *d*	Male (n=257) Cohen's *d*
Average Pain Level (NRS)	0.49	0.39
Highest Pain Level (NRS)	0.30	0.37
Pain Interference in Mobility[1]	0.43	0.32
Pain-related Negative effect[1]	0.52	0.37
Pain Interference in Vitality[1]	1.05	0.76
Pain-related Fear[1]	0.76	0.62
Implausible Symptoms[1,2]	0.85	0.54
Sleep[3]	0.84	0.45
Pain Catastrophizing[4]	0.88	0.64

Notes: NRS – Numerical rating scale; [1]POQ-VA: Pain Outcomes Questionnaire-VA; [2]SIS-Symptom Implausibility Scale within the POQ-VA; [3]SPQ-Sleep Problems Questionnaire; [4]CT-Pain catastrophizing subscale of the Coping Strategies Questionnaire.

The ability to return to work is another important implication for those with persistent pain. A study in Sweden (n=7,297) demonstrated that an interdisciplinary pain management program can move individuals from partial (54%), full-time (58%), and permanent sick leave (30%) at 1 year before the treatment to no sick leave at 2 years after treatment, suggesting long-term effects of the intervention (Rivano Fischer, Persson, Stalnacke, Schult, & Lofgren, 2019).

Table 2.4. Effect size by outcome measures of an 8-week outpatient interdisciplinary pain management program (n=129). (Katz et al., 2019)

Outcome measure	Cohen's *d*
Average pain	0.07
Pain-related interference (PDI)	0.21
Fear of pain/re-injury (TSK)	0.38
Pain catastrophizing (PCS)	0.29
Illness-focused coping (CPCI)	0.18
Wellness-focused coping (CPCI)	0.61
Depression (DASS-21)	0.32
Anxiety (DASS-21)	0.15
Stress (DASS-21)	0.33
Precontemplation (PSOCQ)	0.44
Contemplation (PSOCQ)	0.24
Action (PSOCQ)	0.76
Maintenance (PSOCQ)	0.99
Pain self-efficacy (PSEQ)	0.44

Notes: PDI = Pain Disability Index; TSK = Tampa Scale of Kinesiophobia; PCS = Pain Catastrophizing Scale; CPCI = Chronic Pain Coping Inventory; DASS-21 = Depression Anxiety and Stress Scale; PSOCQ = Pain Stages of Change Questionnaire; PSEQ = Pain Self-Efficacy Questionnaire.

A Cochrane systematic review demonstrated that multidisciplinary intervention for persistent lower back pain had moderate quality evidence for decreasing pain (SDM=0.21, 95% CI 0.04-0.37) and disability (SMD=0.23, 95% CI 0.06-0.40) compared with usual care in 16 studies (S. J. Kamper et al., 2015). In addition, participants in 7 studies had improved odds of returning to work within 1 year after intervention (OR=1.87, 95% CI 1.39-2.53) compared to those receiving usual care designated by healthcare providers (Steven J. Kamper, Maher, & Mackay, 2009).

While evidence demonstrates these interdisciplinary programs are beneficial, there is an ongoing struggle for approval of this treatment method by third-party payers (Ruan & Kaye, 2016). This is because of higher initial costs that result from the length of the program and utilization of multiple providers, however, healthcare costs have been shown to decrease after completion of this type of intervention. Healthcare costs over lifetime for an individual with persistent pain have been calculated to range from $140,000 to $211,000, while lifetime disability costs could be as high as $72,000, not accounting for increase in healthcare prices over time (Gatchel & Okifuji, 2006). Another study demonstrated a four times lower health care utilization during the 12-month period after interdisciplinary treatment, equaling to approximately $10,000 savings in healthcare costs (Gatchel, McGeary, McGeary, & Lippe, 2014; D. D. McGeary et al., 2013; D. D. McGeary et al., 2012).

Another characteristic that may be contributing to possible reluctance toward interdisciplinary pain management is the lack of consistent or optimum dosage for this intervention. A systematic review found that the lack of standardization hinders comparison among trials and can be an obstacle for decision-making in evidence-based practice (Deckert et al., 2016). A more recent study comparing interdisciplinary programs of 8 to 20 weeks duration with similar content, reported no significant difference in outcomes, however, one study is not enough to establish optimal duration (Reneman, Waterschoot, Bennen, et al., 2018). Most often the duration and dosage are established based on historical grounds and clinician expertise therefore more research is needed to determine most cost-effective program duration and content (Loeser, 2006; Reneman, Waterschoot, Bennen, et al., 2018; Reneman, Waterschoot, Burgerhof, et al., 2018). In

addition to clinical expertise, patient input should be central in determining the appropriate components in interdisciplinary pain management because individuals with persistent pain are able to offer true testimony of the experience and how each of the components may or may not have helped. There is little research that has focused on the breadth and depth of the pain experience and process of change as patients go through this type of intervention. The understanding the patients' experience during interdisciplinary pain management should be further investigated in order to help assess and improve the program itself.

Interdisciplinary Intensive Outpatient Program for Persistent Pain in the U.S. Military

The military interdisciplinary pain management programs have grown in number since the Army Pain Management Task Force Report was published in 2010 (Vallerand, Cosler, Henningfield, & Galassini, 2015). Prior to the report, Peters and others (2000) reported on an early interdisciplinary program in the military called: Coping with and Overcoming Pain Effectively or COPE program (n=58). It was a biweekly, three-week program with 90-minute sessions created at Tripler Army Medical Center in Honolulu, Hawaii by the Departments of Anesthesiology, Physical Medicine and Rehabilitation and Psychology. The program focused on the psychosocial aspect of pain addressing mind and body principles, pain physiology education, hypnotherapy, cognitive therapy, education on sleep hygiene, exercise, nutrition and medication use and effective communication with health care providers. Results (Table 2.5) demonstrated improvement in overall quality of life (d=0.45), pain intensity (d=0.40), and relaxation skills (d=1.63), in addition to an 87% decrease in health care utilization in the first 3

months after the program (Peters et al., 2000). The previously described Gatchel, et al (2009) study was also completed in the active duty military population and had similar positive results.

Table 2.5. Effect sizes by outcome measure of a 6-week outpatient interdisciplinary pain program (n=58). (Peters et al., 2000)

Outcome measures	Cohen's *d*
Pain Intensity (0-10)	0.40
Pain Frequency (0-10)	0.39
Self-regulatory skills	
Confidence in ability to relax (0-10)	1.63
Depth of relaxation (0-10)	0.76
Overall (0-500) Quality of Life Index	0.45

To the author's knowledge, there are at least 2 additional studies ongoing at this time at 2 military intensive outpatient pain programs to assess their effectiveness (D. M. Flynn et al., 2017; Pujol et al., 2015). Preliminary results from the functional restoration program in San Antonio, TX reported basic, descriptive results for 14 patients indicating small to moderate improvements in most patients, while the other study has not yet published outcome results (Pujol et al., 2015).

Intensive outpatient pain programs in the military are most frequently utilized after all other treatment options have been exhausted and service members are at a crossroads whether they are able to continue their military service or opt for a medical evaluation board which leads to a medical discharge. Figure 2.3 represents the typical sequence of events prior to enrollment in an IOP based on the author's clinical experience and information gained informally from healthcare providers at one of the military IOPs.

Many service members cycle multiple times between their primary care provider and using a variety of medications, physical therapy and some other form of specialty pain management leading to frustration and anxiety felt by the patient by the time they reach the option of attending the intensive outpatient program. Participants are deemed eligible for the IOP after screening of medical records, interview by the IOP providers and approval from the service member's military commander. The most common reason for denying service members participation in IOP is lack of command approval or other administrative problem rather than any reason specifically related to pain. Despite some service members' transparent lack of motivation or enthusiasm for yet another intervention, most service members are still accepted to attend the program even if they do specifically list the reason for being there as "checking the box" before a medical evaluation board.

The service members who are accepted to attend IOP are then scheduled for the next available date that is also approved by the patient's respective command. Service members occasionally have to cancel their attendance due to mission requirements and wait as long as a year to attend IOP because taking someone out of their job for 3 weeks can be a challenge. Participants are fully released from their military units for the 3-week duration of IOP to focus solely on themselves. They are assessed before and after the intervention including a physical examination, various outcome measures and a physical performance assessment concluded with an interview to determine the next steps for each service member. If there is improvement after IOP, service members return to work with limitations which are reassessed periodically and decreased or eliminated if they become capable to return to full duty. If there is no improvement, regardless of whether it is true

lack of improvement or due to secondary gain, he or she is referred to a medical evaluation board which more often than not leads to a medical discharge.

During the 3-week IOP, each participating service member may go through a greater or lesser transformation but the process of change cannot be fully grasped by pre and post-intervention measurements. While quantitative measures are extremely useful in demonstrating progress made during the intervention and therefore its effectiveness on managing persistent pain, they do not provide information on the course of each individual's change. A recent, qualitative study among veterans who completed a 10-week, 3-hour per week persistent pain self-management program, that included group and individual coaching, found a continuum of change during the program from those unmoved by the intervention through limited adoption of self-care practices, practicing new skills and understanding, and whole life change, providing insight into the process of change during an intervention (Penney & Haro, 2019). In addition, the study reported some of the most common barriers and challenges for maintenance of self-management experienced by veterans after the program such as: life disruptions, not enough training and forgetting skills, lack of resources and social support, competitive demands and lack of balance, providing useful data that can inform future intervention (Penney & Haro, 2019).

Due to the prevalence of persistent pain in active duty service members and little research in this population that focuses on understanding the process of change, there is a need for further exploration in this area. Investigating patient progress during the entire course of the intervention and not only at the completion of interdisciplinary pain management can provide insight into the evolution of the experience of pain that has not

been described in the past. This type of exploration can help improve the understanding of persistent pain, characteristics of the patients and the program that contribute to the overall outcomes and whether earlier program enrollment would be beneficial, informing future program referral patterns.

Patient Activation

Patient activation is conceptualized as the level of self-involvement and ability to self-manage one's health care which in turn affects health outcomes (Hibbard, 2004; Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997). A number of measures exist to assess various aspects of activation such as self-efficacy, or locus of control but none of those addressed the multiple domains in one measure (Hibbard et al., 2004). The Patient Activation Measure (PAM) which was designed to assess patient skill, knowledge, and confidence for self-management is versatile and can be used with many different conditions (Hibbard et al., 2004). The measure is scored on a theoretical 0-100 scale and a four point change in the score constitutes a clinically significant difference (Hibbard, Mahoney, Stockard, & Tusler, 2005). The scale differentiates four levels of activation which include: (1) lack of belief that patients have an active and important role in their own health and may expect a healthcare provider will "fix" them (0-47): (2) lack of confidence and knowledge to take action (47.1-55.1); (3) beginning to gain confidence and take action (55.2-67.0); and (4) maintaining confidence and skills to manage own health over time (67.1-100) (Hibbard, Mahoney, Stock, & Tusler, 2007; Hibbard et al., 2005). A change of 4 points on the PAM has been shown to be related to changes in health behaviors such as regularly eating breakfast and having the knowledge to recognize reliable health information (Fowles et al., 2009).

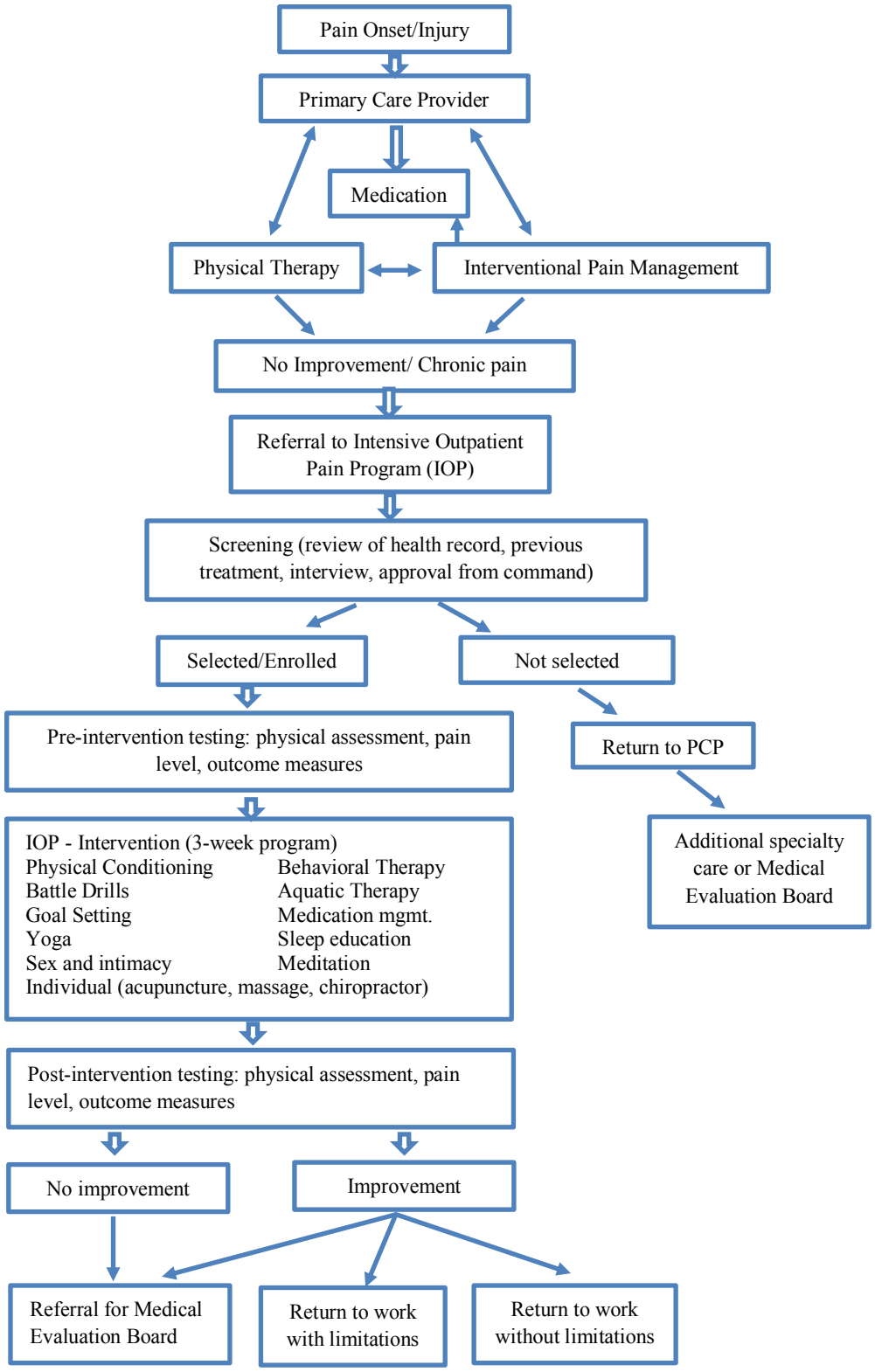

Figure 2.3. Typical sequence for service members with persistent pain navigating through healthcare including the IOP.

The initial 22-item measure (r=0.87) was further tested and yielded a 13-item short-form with comparable reliability (r=0.81) (Hibbard et al., 2005). Construct validity was assessed by linking patient preventative and disease-specific behaviors between the two measures which resulted in little difference between the long and short form (Hibbard et al., 2005). The PAM has robust psychometric properties not only in patients with chronic illness but also in other populations such as employed populations (Fowles et al., 2009). A survey of 625 employees in two industries found the person reliability using Rasch analysis was 0.83, item reliability averaged 0.99, and internal consistency was 0.90 (Fowles et al., 2009). Furthermore, bivariate analysis in this study found that, activation was directly related to measures of physical and mental health status components of the SF-12, engaging in healthy behaviors, readiness-to-change and seeking health-related information, while age, gender, job category or satisfaction were not related to activation (Fowles et al., 2009).

In a population-based sample of individuals with cardiovascular disease and diabetes, patient activation was related to the frequency of primary care visits with more frequent visits for PAM level 1 and 2 patients with cardiovascular disease (OR 1.7; 95% CI 1.0-2.7) and diabetes (OR 1.4; 95% CI 0.8-2.5) compared to those with patient activation level 4 (Donald et al., 2011). Another study reported that individuals with a variety of chronic illnesses with level 4 PAM scores were almost 3 times more likely to have high medication adherence, 5 times more likely to report high quality of life and more than 10 times more likely to report patient satisfaction with their healthcare services compared to the individuals with level 1 PAM scores (Mosen et al., 2007). Patient activation in patients attending primary care appointments in Israel (n=278) was related

to a quality of life questionnaire (r=0.39, p<.0001) and inversely related to a self-reported depression screening tool (r= -0.35, p<.0001) (Magnezi, Glasser, Shalev, Sheiber, & Reuveni, 2014). Findings of a systematic review of 10 studies indicated that individuals at levels 1 and 2 of the PAM scores were more likely to be hospitalized (IRR=1.93, 95% CI 1.22-3.06) and utilize emergency room services (IRR=1.68, 95% CI 1.07-2.63) than individuals at levels 3 and 4 but there was inadequate evidence to establish a relationship between PAM score and medication adherence (Kinney et al., 2015). Consistent with the previous studies, a retrospective study with data extracted from an electronic health record (n=98,142) reported that patients at level 1 of PAM scores were more likely to be hospitalized compared to patients at level 4 (ORs 1.30-1.62) and patients at level 1 were also more likely to be newly diagnosed with a chronic disease within the 3 years of observation compared to patients at level 4 (ORs 1.21-1.31) (Hibbard, Greene, Sacks, Overton, & Parrotta, 2016).

It has been proposed that utilizing PAM scores may aid providers in identifying at-risk patients and selecting more tailored and appropriate interventions based on patient activation level which may contribute to more timely and potentially more aggressive disease management as well as timely discharge to self-management when the patient reaches an appropriate activation level (Hibbard et al., 2007). An increasing number of patient-centered medical home clinics are measuring patient activation to help tailor care and treatment plans (Greene & Hibbard, 2012). Interventions shown to successfully increase activation levels, especially in those on the lower end, focus on several factors including skill development, problem solving, peer support, changing the social

environment, and tailoring the intervention to an individual's activation level (Hibbard & Greene, 2013; Roberts et al., 2016).

In one study (n=479), a community intervention addressing self-management, appropriate use of medications, effective communication and nutrition, showed that at 6 weeks the intervention group had significantly higher activation compared to the control group (F=13.44, p<.001) but at 6 months, the difference was not significant anymore (F=2.344, p=.127) because the control group also showed increased activation (Hibbard et al., 2007). Regardless of initial group assignment (intervention or control), those who were found to be in an increased growth class had higher activation at baseline (M=72.0) compared to those who were in the stable growth class (M=62.1) with the difference between the two classes increased to 26 points at 6 months after the intervention with a mean of 87.4 points for the increased growth class and 61.7 for the stable growth class (Hibbard et al., 2007). The behaviors assessed included engaging in regular exercise, following a low-fat diet, reading food labels, managing stress, maintaining recommended weight, and additional behaviors that were disease specific to hypertension, arthritis or diabetes (Hibbard et al., 2007). While positive change was noted in both groups, increase was greater in the increased growth class on 14 of 18 behaviors (p<.01) (Hibbard et al., 2007). Another study (n=320) showed that changes in PAM scores after a health promotion intervention were related to significant changes in the overall health risks score measured by Personal Wellness Profile (b=0.29, p<.001) and its components including aerobic exercise (b=0.3, p=.005), safety (b=0.36, p<.001), cancer risk (b=0.16, p=.002), stress (b=0.17, p=.004) and mental health (b=0.11, p=.007) (Harvey, Fowles, Xi, & Terry, 2012).

While various interventions have been shown to increase patient activation, one RCT (n=121) demonstrated no significant change in patient activation after a 2.5-hour weekly, 6-week self-management program for persistent pain based on elements of cognitive-behavioral therapy (*MD*= -0.5, 95% CI -4.8-3.7, *p*=.802) (Nost et al., 2018). It is therefore unclear what type of interventions can increase patient activation in individuals with persistent pain and whether the change in activation is related to other changes in this population. PAM has not been used to assess patient activation in individuals receiving interdisciplinary pain management treatment. Evaluating patient activation in an intensive pain program can gauge the program's effectiveness in increasing activation and may help demonstrate whether the program changes understanding, emotional response and confidence in self-management of persistent pain. As discussed above, PAM has been used in a variety of chronic conditions but there is a lack of studies assessing patient activation changes after interventions for persistent pain, which could determine the effectiveness of intervention and help tailor it. Patient activation has not been assessed in military service members and may provide additional insight on activation in this specific population.

Conceptual Framework

The proposed research is guided by a conceptual model (Figure 2.4) which was adapted from the Patient-Centered Multi-Level Personalized Patient Activation and Empowerment Framework (Chen, Mullins, Novak, & Thomas, 2016). This model was developed to inform the creation of interventions that will empower and activate patients to improve their health and decrease health disparities (Chen et al., 2016). It considers the treatment delivery system, healthcare providers, and community support and their

contribution to change in patient activation and the overall outcome of an intervention. The adapted conceptual model presents the intensive outpatient program as the treatment delivery system, the characteristics of health care providers such as trust and communication and community support which includes family, friends, the military environment and other resources that may be available (Greene & Hibbard, 2012; Hibbard et al., 2007; Mosen et al., 2007). Patient activation comprises of knowledge, confidence and self-management skills and is also influenced by individual characteristics and past and present experiences (Hibbard et al., 2004). Patient activation is influenced by the intervention, health care providers and community support and therefore is placed within the bounds of those components. All of the above components combined result in an individual's outcome or a complex experience of persistent pain. Based on previous qualitative studies, the experience includes not only perceived pain level but also self-perceived disability and personal control, attitude, physical function, knowledge and understanding of pain in order to move forward alongside of pain which describes the outcome in the model (de Rooij, van der Leeden, Roorda, Steultjens, & Dekker, 2013; Toye, Seers, Hannink, & Barker, 2017). An effective treatment program for persistent pain should address all of these components in order for participants to have the best chance of a successful outcome.

Summary and Knowledge Gaps

The understanding of and treatment for persistent pain continues to evolve as research continues. The most current pain theory leans on gate-control theory and neuromatrix theory with the biopsychosocial model as the most holistic approach to understanding and management of pain (Gatchel et al., 2007; Moseley, 2003). Due to the

complexity of persistent pain, assessment with unidimensional tools has not been adequate and use of various multidimensional tools is becoming more common as understanding of pain increases. Evaluating physical function, cognitive, behavioral and emotional factors including sleep quality, coping strategies, healthy or unhealthy behaviors, and expectations will result in a comprehensive assessment of persistent pain (Dennis C. Turk et al., 2016). Qualitative methods, used less commonly, can also explore the depth of benefit or lack of benefit, and changes that were expected, unexpected or unmeasurable quantitatively. Patient narrative and observed behavior during an intervention like the intensive outpatient program requires further research and may provide context to inform the process of change in individuals participating. It may also assist with developing and revising the intervention further, resulting in increased support for interdisciplinary program as an effective treatment for persistent pain.

A variety of interventions exist for persistent pain, with more or less effectiveness, including biomedical, psychological, exercise-based programs and what are considered complementary therapies (ie. yoga, acupuncture). While biomedical treatments for pain can be effective for certain conditions, in the case of persistent pain, patients and providers often look for alternate interventions to manage pain without the use of medications and other invasive procedures leading to interdisciplinary pain management programs as a feasible choice. Psychological interventions have been gaining traction including cognitive-behavioral treatment which addresses the emotional and cognitive factors such as fear of movement and reinjury, perception of disability, negativity, catastrophizing or acceptance and moving alongside pain. Due to stigma toward mental health, especially in the military, psychological treatment often encounters

resistance from patients. Gaining insight into the process of acceptance of this treatment component for persistent pain warrants further investigation and an interdisciplinary intensive treatment program provides a practical setting for an inquiry while receiving the intervention. Research assessing the effectiveness of complementary therapies is sparse and only starting to grow however, even with the lack of strong evidence, people with persistent pain are increasingly turning to complementary treatment and management strategies because of endorsement by healthcare providers and inclusion of these treatments in interdisciplinary pain management programs.

Intervention components vary in interdisciplinary intensive pain management programs. In addition to clinical expertise used to determine the composition of such programs, patient input should be central in determining the appropriate components because individuals with persistent pain are able to offer true testimony of the experience and how each of the components may or may not have helped. There is little research that has focused on the breadth and depth of the pain experience and process of change as patients go through this type of intervention. The understanding the patients' experience during and intensive outpatient program should be further investigated to then assess and improve the program itself.

Prevalence of persistent pain is higher than in the general population with up to 73.2% of veterans dealing with some sort of persistent pain compared to 30% in the general population (Institute of Medicine Committee on Advancing Pain Research & Education, 2011; Van Den Kerkhof et al., 2014). There is little research in this population that focuses on understanding the process of change in persistent pain, needing further exploration in this area. Investigating patient progress during the entire course and not

only at the completion of an intervention such as the intensive outpatient program, can provide insight into the evolution of the experience of pain that has not been described in the past. This type of exploration can help improve the understanding of persistent pain in this specific population, characteristics of the patients and the program that contribute to the overall outcomes and future program referral patterns.

Lastly, patient activation has been measured in individuals with various chronic conditions but it is unclear what type of interventions can increase patient activation in individuals with persistent pain and whether the change in activation is related to other changes in the military population receiving interdisciplinary pain management treatment. Evaluating patient activation in an intensive pain program can gauge the program's effectiveness in increasing activation and may demonstrate whether the program changes understanding, and confidence in self-management of persistent pain. Patient activation has not been assessed in military service members and may provide additional insight on activation in this specific population.

The main objectives of this research were to address the knowledge gaps in the understanding of the process of change during an intervention for persistent pain, change in patient activation and assess the feasibility and acceptability of monitoring various indicators in military service members participating in an interdisciplinary intensive outpatient program.

Specific Aim 1: To improve understanding of the experience of persistent pain in military service members participating in an Intensive Outpatient Pain Program (IOP) to inform further intervention.

Research Question 1: How do the course of persistent pain and self-perceived disability evolve throughout the IOP?

Research Question 2: How do past and present experiences affect the participation in the IOP and development of short and long-term goals?

Research Question 3: What role do health care providers and community components such as social support, family, and military have in a service member's experience of persistent pain?

Specific Aim 2: To assess the change in patient activation following an intensive outpatient program for military service members with persistent pain and to determine whether change in activation is associated with outcomes in the program including kinesiophobia, pain interference, and physical function.

Research Hypothesis 1: Patient Activation Measure (PAM-13) scores will significantly increase upon completion of the intensive outpatient program.

Research Hypothesis 2: Measure of pain intensity will significantly decrease upon completion of the intensive outpatient program.

Research Hypothesis 3: Measures of pain interference will significantly decrease upon completion of the intensive outpatient program.

Research Hypothesis 4: Measure of fear of movement will significantly decrease upon completion of the intensive outpatient program.

Research Hypothesis 5: Measures of physical function will significantly increase upon completion of the intensive outpatient program.

Research Hypothesis 6: Patient Activation Measure (PAM-13) scores will be negatively associated with fear of movement at both baseline and upon completion of the program.

Research Hypothesis 7: Patient Activation Measure (PAM-13) scores will be negatively associated with pain intensity at both baseline and upon completion of the program.

Research Hypothesis 8: Patient Activation Measure (PAM-13) scores will be negatively associated with pain interference at both baseline and upon completion of the program.

Research Hypothesis 9: Patient Activation Measure scores (PAM-13) will be positively correlated with physical function assessment at both baseline and upon completion of the program.

Specific Aim 3: To explore the feasibility and acceptability of ecological momentary assessment using a smartphone application for daily reporting of pain, psychosocial indicators and attitudes of service members engaging in a treatment program for persistent pain.

Research Question 1: What are the compliance rates and satisfaction with daily completion of an ecological momentary assessment survey during a 3-week intensive outpatient program?

Research Question 2: What are service members' perceived pain and stress levels, attitudes about the program components, and social support perceptions as they progress through the program?

Research Question 3: How does the use of a smartphone application to assess daily pain, stress, social support and attitudes during a treatment program enhance the understanding of persistent pain?

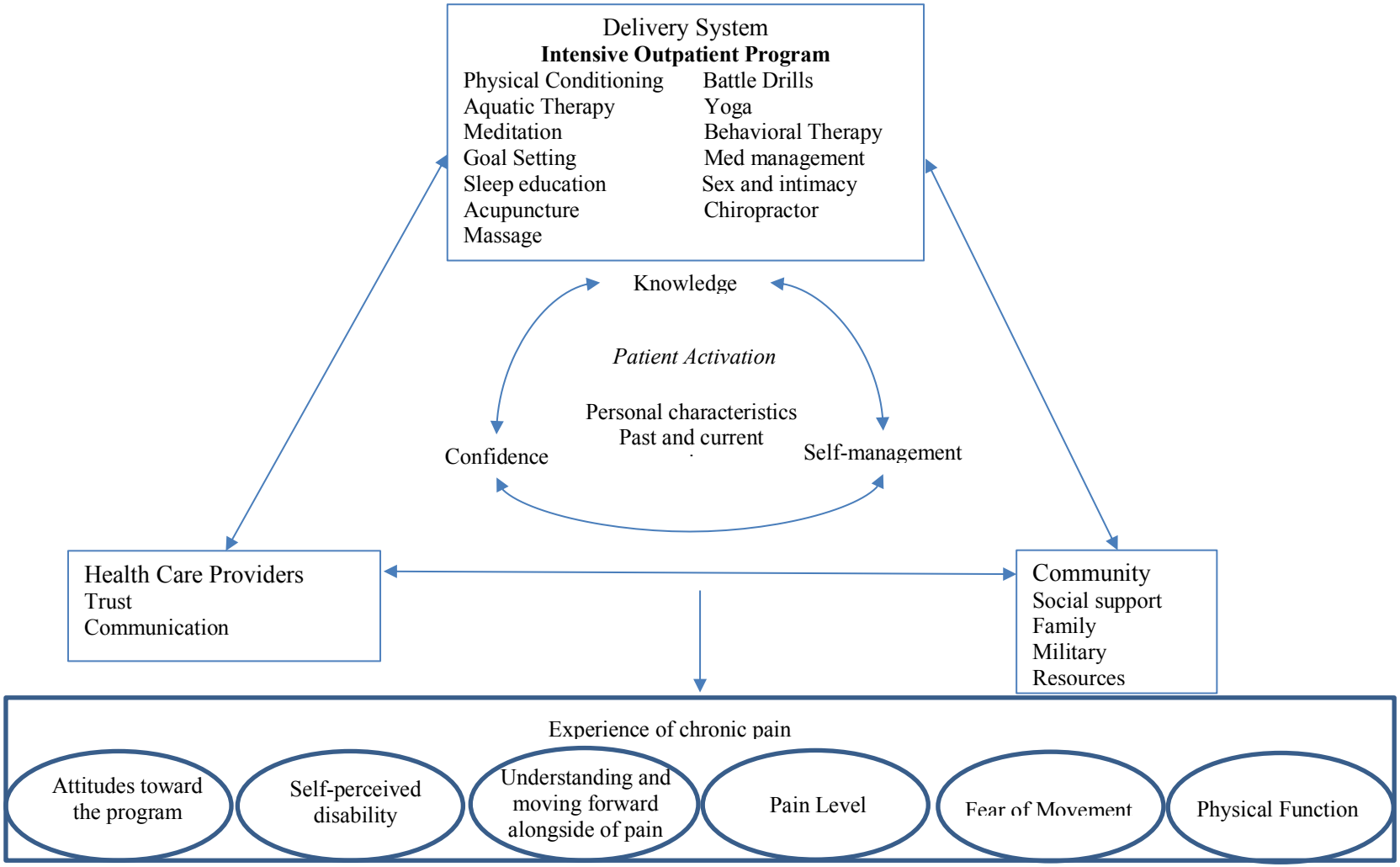

Figure 2.4. Conceptual model of the experience of persistent pain in an intensive outpatient pain program in the context of the military.

CHAPTER 3
RESEARCH DESIGN AND METHODS

This research was a mixed-method study design with the utilization of prospective and retrospective data to explore various aspects of the experience of persistent pain in military service members while attending an interdisciplinary intensive outpatient program. The setting, sample population, qualitative and quantitative methods for each study are described below.

Setting

Interdisciplinary intensive outpatient programs for persistent pain have been functioning for over fifty years (Ruan & Kaye, 2016). In the military, interdisciplinary pain management has evolved in the last 10 years since the Army Pain Management Task Force was created affecting pain management services military-wide (Office of the Army Surgeon General Pain Management Task Force, 2010). Several intensive outpatient programs were created including one at Dwight D. Eisenhower Army Medical Center (DDEAMC) at Fort Gordon, GA. This program is defined as

> "a unique functional rehabilitation program designed specifically for military men and women who are motivated to increase physical and mental performance and improve self-management of chronic pain. This comprehensive, multidisciplinary program incorporates military structure, discipline, education, and functional

exercise to achieve improved resilience and reduced reliance on medication." (Interdisciplinary Pain Management Center, n.d.).

The interdisciplinary intensive outpatient program (IOP) for persistent pain is a full-time, 3-week treatment program with 85 hours of various group and individual therapies and education including: 10 hours in-classroom education on pain neuroscience, sleep, medication management and goal setting; 10 hours of group behavioral therapy; 12 hours each of meditation and yoga; 6 to 8 hours of individual complementary therapy such as acupuncture, massage, and chiropractic treatments; and over 45 hours of physical conditioning and exercise including physical readiness training, aquatic therapy, adventure therapy, group rehabilitation and circuit training, advance exercise, and Soldier skills. On the first and last day of the program, evaluation and assessment are completed including a physical examination, various patient reported outcomes and a physical function assessment (Appendix A). The interdisciplinary team includes a pain physician, physiatrist, neurologist, pharmacist, acupuncturist, chiropractor, behavioral health specialist, nurse case manager, yoga instructor, massage therapist, occupational therapist, and physical therapist.

Sample Population

The research study included patient participants who were active duty service members from any of the military services suffering from persistent pain, were determined eligible and were enrolled in the Intensive Outpatient Pain Program at DDEAMC. Eligibility of patient participants was determined by IOP staff including a physician, physician assistant, pharmacist, and a nurse case manager. The majority of

participants were stationed at Fort Gordon, GA with some participants coming to DDEAMC specifically for the program on temporary duty assignment (TDY) from various other military posts. Participants were required to have command approval in order to be released from duty to participate in the full three-week program. All participants received treatment that is standard to the intensive outpatient program. No additional intervention was added and there was no control group. Staff members who were actively working in the IOP were also recruited for the qualitative potion of the study. Retrospective data was extracted from January 2017 through August 2018 for the quantitative analysis while prospective data was collected between September 2018 and December 2018 for the qualitative analysis.

IRB approval

This research was reviewed and approved by the Department of the Army Regional Health Command – Atlantic and the University of South Carolina Institutional Review Boards.

Aim 1: Understanding the experience of chronic pain in military service members participating in an Intensive Outpatient Pain Program

The purpose of this study was to gain a deeper understanding of the evolution of pain, past and present experiences, attitudes, preferences, and goals while attending an intensive outpatient program which results in some participants benefitting more than others. This study evaluated the pain experience of participants and how it changed through the IOP. It sought to comprehend the impact of the program on service members'

lives and perception of their own disability in addition to identifying barriers and enablers for attendance in the program and self-management after completion.

Specific Aim 1: To improve understanding of the experience of persistent pain in military service members participating in an Intensive Outpatient Pain Program (IOP) to inform further care and maximize effectiveness of the intervention.

Research questions:

1. How do the course of persistent pain and self-perceived disability evolve throughout the IOP?

2. How do past and present experiences affect participation in the IOP and development of short and long-term goals?

3. What role do health care providers and components such as social support, family, and military have in a service member's experience of persistent pain?

Participants and Recruitment

Participants were recruited from the IOP at DDEAMC between September and December 2018. All participants were military service members, suffering from persistent pain who were determined eligible for the program by in interdisciplinary team of providers. All participants were referred to the program by their primary care physician or a specialty clinic and have had various treatments in the past, which included but were not limited to physical therapy, medications and interventional pain management that did not sufficiently manage their symptoms. Participants were recruited on the first day of three consecutive cycles of IOP. An IOP staff member was present to

make sure participants were free to consent or decline participations without any repercussions or alterations in their treatment. Participation was encouraged for the benefit of service members with persistent pain, improvements in the program and overall military medicine. No ombudsman was required for this study per the Army IRB. Interested participants were then given a consent form and HIPAA authorization forms to read and sign (Appendix B). No incentives were provided to the participants for the study.

Staff members were recruited at the beginning and throughout the duration of the study based on availability. The PI briefly described the purpose of triangulation of data and staff inclusion in the study. Interested staff members were scheduled for interviews at their convenience. No incentives were provided to staff members for participating in the study.

Data Collection Procedures

After providing written consent, each patient participant was assigned a unique identifier for confidentiality (Appendix B). Participants filled out a basic demographic information sheet including age, sex, marital status, branch of service, military rank, time in service, number of deployments, and pain duration (Appendix C). The rest of the data collection involved semi-structured interviews. If any of the subjects declined audio recording of the interview, the PI took copious written notes. Data from patient participants was collected at several points during the course of the program. Pre-IOP and post-IOP semi-structured interviews, lasting between 20-30 minutes, were conducted during breaks in the program or at another time and place convenient for the participant.

The initial interviews took place within the first two days of the program and the post-IOP interviews took place on the last two days of the program. Two brief (<10 minutes) interviews were completed on Fridays of the first and second weeks of IOP to ask about the previous week's experience and progress toward goals. Figure 3.1 depicts a flowchart with timing of the interviews during the program. All semi-structure interviews with patient participants were conducted by the PI. All interviews were audio recorded on 2 devices except one interview for which the patient participant declined recording. The PI took detailed notes while interviewing the participant.

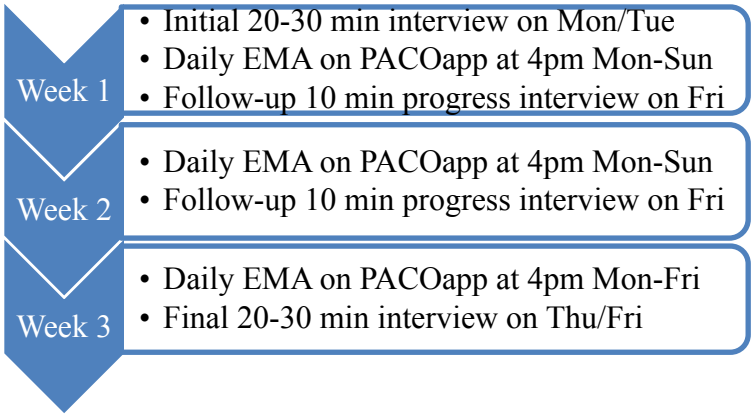

Figure 3.1. Data collection timeline for each individual patient participant over the 3-week IOP timeline for Specific Aim 1 and 3.

Each staff participant signed a consent form prior to their interview and was given an identifier to preserve confidentiality (Appendix B). Staff participant interviews were completed by the PI, using semi-structured interview guides, lasting 20-30 minutes and were conducted during breaks in the program, or another time convenient for the staff participant.

The PI was a participant-observer during the entire program observing and participating in all of the group education classes, treatment and exercise sessions at least once. All audio recordings and transcripts of the interviews were stored digitally on a password protected computer. All physical copies of field notes and demographic sheets were transcribed into a digital form and stored in a locked cabinet until completion of the study after which they were destroyed.

Instruments

The patient participant interview guides were developed to prompt discussion about biopsychosocial understanding of pain, impact of past and present personal and professional experiences, priorities, goals and attitudes toward the program (Appendix C). The development was also guided by the biopsychosocial model, conceptual framework described previously in chapter 2, and IOP intervention components to improve understanding of the participants' experience and effects of the program on pain perception. Questions asked about the participants' history of pain, past treatments and interactions with healthcare providers, perceived social support and how the pain has affected various aspects of their lives. During the program, participants were asked about their goal progress, what components were found more or less beneficial, what increased and decreased pain, how the understanding of pain and expectations for future changed as a result of the program.

The staff participant interview guides were used for triangulation of data from patient participant interviews (Appendix D). The interviews addressed staff perceptions of the patient participants, group dynamics and how they affect program participation,

process of change, type of patients who are most likely to benefit, and overall impression of the program.

The PI utilized observation checklists and field notes for documentation, noting the setting, environment, delivery of the program, patient and staff interactions, patient engagement and progression in the program (Appendix E). Participant observation conducted during the program provided additional data to triangulate with patient and staff participant interviews.

The patient interview guides were pilot-tested on 4 individuals with and without persistent pain and based on the feedback, questions were modified or revised for maximum clarity and understanding. The staff interview guides were reviewed and discussed by 3 researchers and revised based on feedback. The full interview guides for pre-IOP, post-IOP and weekly follow-up interviews for patient participants, interview guides for staff participants and participant-observer checklists can be found in appendices C-E.

Data Analysis

All interviews were transcribed verbatim by a professional service and verified by the PI. Transcription and data analysis were performed concurrently with data collection. Data were analyzed using NVivo 12 Plus qualitative analysis software (NVivo Qualitative Data Analysis Software, 2016). IBM® SPSS® v.24.0 (Amonk, NY:IBM Corp) was used to calculate descriptive statistics.

Data was analyzed using constant comparative method and the following steps were taken for credibility of findings (Strauss, 1998): (1) a preliminary codebook with

organizational and theoretical categories was developed by the PI based on review of the literature, conceptual framework and clinical experience; (2) initial interview transcripts for 5 patient participant (20% of all interviews) were coded by one author using the initial codebook and additional codes were added as they emerged during the analysis in an effort to capture all insights from participants; (3) the interviews were then coded by a second coder for peer review, to assure agreement in coding technique and to gain input and additional themes and nodes that may have been overlooked. After discussion and review of the double coded interviews, an overall .73 kappa agreement was calculated which is considered substantial agreement (McHugh, 2012); (4) iterative coding was then completed for the rest of the interviews with themes identified across all interviews addressing changes in perception of pain, attitudes, barriers and enablers, impact of past and present experiences and effectiveness of the program on future goals; (5) categorization of patient participants by similarities in experience was concurrent with data collection and analysis; (6) categorization of interviews by time; (6) staff interviews and observation notes were coded using patient participant codebook and used to triangulate the data to gain additional insight about different aspects of pain experience, group dynamics, program effects and to corroborate the findings and decrease researcher bias and reactivity from using only one methods of data collection (Maxwell, 2013); (7) matrices were created to explore the progression of biopsychosocial model understanding, functional and physical performance changes, psychosocial changes such as fear of movement, perceived social support and confidence in self-management, perceived pain changes, short and long-term goals, and future expectations during the three-week intervention.

Aim 2: Patient activation changes and its relationship with fear of movement, pain interference, and physical function

The purpose of this study was to examine the changes in and relationship between patient activation and fear of movement, pain interference, and physical function assessment pre- and post- interdisciplinary intervention in an IOP for military service members with persistent pain.

Specific Aim 2: To assess the changes and relationship between patient activation and fear of movement, pain interference, and physical function assessment pre- and post-interdisciplinary intervention in an intensive outpatient program for military service members with persistent pain.

Research hypothesis:

1. Patient Activation Measure (PAM-13) scores will significantly increase upon completion of the intensive outpatient program.
2. Measure of pain intensity will significantly decrease upon completion of the intensive outpatient program.
3. Measures of pain interference will significantly decrease upon completion of the intensive outpatient program.
4. Measure of fear of movement will significantly decrease upon completion of the intensive outpatient program.
5. Measures of physical function will significantly increase upon completion of the intensive outpatient program.

6. Patient Activation Measure (PAM-13) scores will be negatively associated with fear of movement at both baseline and upon completion of the program.
7. Patient Activation Measure (PAM-13) scores will be negatively associated with pain intensity at both baseline and upon completion of the program.
8. Patient Activation Measure (PAM-13) scores will be negatively associated with pain interference at both baseline and upon completion of the program.
9. Patient Activation Measure scores (PAM-13) will be positively correlated with physical function assessment at both baseline and upon completion of the program.

Data Acquisition and Procedure:

This was a retrospective analysis of data extracted from the IOP from January 2017 through August 2018. All intake forms and outcome measures were designed and selected by the DDEAMC Interdisciplinary Pain Management Center based on empirical evidence and clinical judgement. Data was extracted and de-identified for analysis. Each participant was assigned an identifier with their IOP session number followed by 01, 02, etc. Example: 43_01. The original paper records were not removed from the office in which they were stored and the digital master dataset was stored on a password protected computer. The de-identified digital dataset was used for analysis. The dataset included all patient participants in the treatment program during the above time frame. The IOP staff accepts 8 to 12 service members to participate in each session. There were approximately 8 sessions per year. The demographics collected included age, sex, military occupational specialty (MOS), military rank, branch of service, time in service, number and length of deployments, persistent pain duration, tobacco use, and whether participants were already receiving some type of behavioral health services at the start of the program.

Measures

Patient Activation Measure was designed to assess patient skill, knowledge, and confidence for self-management fit for various medical conditions (Hibbard et al., 2004). PAM short-form, used in the IOP, is the reduced version of PAM, from 22 to 13 items and has comparable reliability (r=0.87, r=0.81 respectively) (Hibbard et al., 2005). The measure is scored on a 0-100 scale with higher scores indicating higher patient activation (Hibbard et al., 2005). The scale differentiates four levels of activation which include: (1) belief that active role is important; (2) confidence and knowledge to take action; (3) taking action; and (4) staying the course under stress (Hibbard et al., 2007; Hibbard et al., 2005).

Defense and Veterans Pain Rating Scale (DVPRS) was developed in 2010 as a result of a recommendation which came out of the Army Pain Management Task Force assessing pain management across the entire Department of Defense (DoD) (Buckenmaier et al., 2013). The DVPRS is a numerical pain assessment tool from 0 to 10 with descriptors, facial expressions and color-coding corresponding to the numbers. Additional four questions about pain interference with sleep, activity, mood, and stress are reported on the same scale from 0 (does not interfere) to 10 (completely interferes) (Buckenmaier et al., 2013). Measures from this scale were shown to be reliable (Cronbach's alpha = 0.871) and had high test-retest reliability (r= 0.637 to r= 0.774) (Polomano et al., 2016).

Tampa Scale of Kinesiophobia-17 (TSK-17) was developed to assess fear of movement and re-injury in populations with persistent pain (Miller RP, 1991). The score

ranges from 17 to 68 with lower scores indicating no or minimal fear and higher scores indicating greater fear of movement, re-injury and avoidance behavior (Miller RP, 1991; Vlaeyen JW, 1995). Initially, validated in Dutch, the English version of the TSK-17 was also shown to be reliable and valid in populations with persistent pain with high internal consistency reliability (Cronbach's alpha = 0.84). (French, France, Vigneau, French, & Evans, 2007; Goubert et al., 2004). The cut-off score for the TSK-17 is 37, with scores higher than 37 indicating high fear of movement and low response in a treatment program and scores lower than 37 indicating lower fear of movement and high response to treatment (French et al., 2007; Vlaeyen JW, 1995).

Physical function assessment was specifically created for the purpose of this IOP and was based on Army standards. High physical capacity is a key aspect of being in the military. Meeting the standard on an annual Physical Fitness Test (PFT) is the minimum requirement for all service members in addition to other physical demands based on occupational requirements (U.S. Army, 2012). Various additional physical assessments exist based on military service and military occupation with most recent adoption of the Occupational Physical Assessment Test (OPAT) administered to all Army recruits (U.S. Army, n.d.). The IOP interdisciplinary team combined portions of various military physical assessments and other functional movements to create a physical function assessment for the IOP. In our analysis, we used three of the events on the assessment which are currently used in at least one of the military fitness tests. The deadlift and interval aerobic run measuring lower extremity strength and aerobic capacity respectively, were taken directly from Occupational Physical Assessment Test (U.S. Army, n.d.). In order to pass the deadlift and run portions of the OPAT with a "gold"

rating or lowest passing score, Soldiers must perform a 120-pound deadlift and run one mile over the course of 36 shuttles within 10:27 minutes (U.S. Army, n.d.). The push-up measures muscle endurance, upper body and core strength reflecting one component of the Army Physical Fitness Test (U.S. Army, 2012). The number of push-ups required to pass the test varies based on the military service, sex and age; for example, a male Soldier, 17-21 years old, is required to perform a minimum of 42 push-ups, while a female in the same age range needs a minimum of 19 pushups in order to receive 60 points, the lowest passing score, for this event on the Army PFT (U.S. Army, 2012).

Data Analysis

G*Power calculation was utilized for a-priori power calculation (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, & Buchner, 2007). In addition, previous literature on TSK-17 pre and post-intervention differences was reviewed because the responsiveness and clinically meaningful changes were most widely published for this measure (Table 3.1). Based on the TSK-17 studies and G*Power calculation, with alpha at 0.05, power at 0.80, two-tailed test and medium effect size of 0.3, it was proposed that this study contain 90-100 participants. This was a feasible number with the data that had been collected and was available for the study.

Demographic characteristics were summarized using descriptive statistics. Means, standard deviations, 95% confidence intervals (CI), and effect sizes were calculated for all outcome measures and physical function assessment. Correlations were performed to examine associations between PAM-13, TSK-17, DVPRS, and the physical function assessment components. Spearman rank correlation was used to assess the strength of

associations and relationships for the data because normality of data could not be assumed and variables were measured on a scale (Debbie L. Hahs-Vaughn, 2013). P-values and r-coefficients were reported ($p \leq 0.05$). All data was analyzed using IBM® SPSS® v.24.0 (Amonk, NY:IBM Corp).

Table 3.1. Tampa Scale for Kinesiophobia power calculations

Article	Effect Size	Sample Size needed for .80 power	Sample size in study
(Comachio, Magalhães, Campos Carvalho e Silva, & Marques, 2018)	0.249	124	132
(Monticone, Ambrosini, Rocca, Foti, & Ferrante, 2017)	1.63-1.77	6	180
(Monticone, Ambrosini, Rocca, Foti, & Ferrante, 2016)	1.49	6	205
(Luning Bergsten, Lundberg, Lindberg, & Elfving, 2012)	0.65	22	265

Aim 3: Feasibility of ecological momentary assessment in an intensive outpatient program

The purpose of this study was to assess the feasibility of using a mobile app to monitor daily self-reported pain intensity, perceived stress, social support, goal progress, and attitudes in an intensive outpatient program for persistent pain.

Specific Aim 3: To assess the feasibility and acceptability of ecological momentary assessment using a mobile phone application for daily reporting of pain

perception and attitudes of service members engaging in treatment program for chronic pain.

Research questions:

1. What are the compliance rates and satisfaction with daily completion of an ecological momentary assessment survey during a 3-week intensive outpatient program?

2. What are service members' perceived pain and stress levels, attitudes about the program components, and social support perceptions as they progress through the program?

3. How does the use of a mobile phone application to assess daily pain, stress, social support and attitudes during a treatment program enhance the understanding of chronic pain?

Participants and Recruitment

Participants were recruited from the Intensive Outpatient Program (IOP) at DDEAMC between September and December 2018. All participants were military service members, suffering from persistent pain who were determined eligible for the program by in interdisciplinary team of providers. All participants were referred to the program by their primary care physician or a specialty clinic and have had various treatments in the past, which included but were not limited to physical therapy, medications and interventional pain management that did not sufficiently manage their symptoms. Participants were recruited on the first day of three consecutive cycles of IOP.

Interested participants were then given a consent form and HIPAA authorization forms to read and sign. No incentives were provided to the participants for the study.

Ecological Momentary Assessment

The Personal Analytics Companion or PACO© application (Paco Developers, v 1.1.8), was used for data collection (Figure 3.2). The application is an open-source platform designed to be used for behavioral research and can be used on both Android and iOS smartphones. Participants had to have access to a smartphone in order to participate. The application collected information including device information, phone number, and usage to allow it to function properly but this data was not recorded or used in the study to ensure confidentiality. Each participant was assigned with a study name (e.g., [study name]) and study email address (e.g., study_email@gmail.com) that was not associated with their name or personal email address to use as a login for the app.

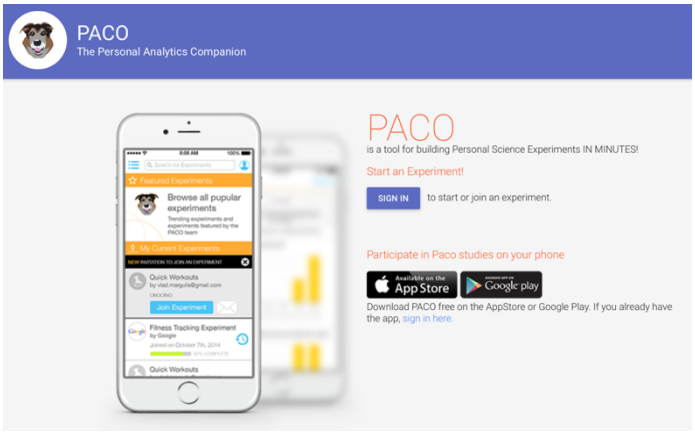

Figure 3.2. The PACO Application.

Data collection

After providing written consent, participants filled out a basic demographic information sheet including age, sex, marital status, branch of service, military rank, time

in service, number of deployments, and pain duration. Participants were then coached through the installation of the application on their smartphones, logging in using their study email address, and enrolling in the study once in the application. The application was set to prompt participants at 4pm daily to answer the survey. The participants then received no more than two additional prompts to complete the survey each day (at 6pm and 9pm). Once the daily survey was completed by the participant, he or she did not receive any more reminders that day. Due to the intensity of the schedule, an end of day assessment was used to prevent disruption during program activities. The use of end of day assessment has been shown to be reliable and valid when compared to random daily assessments in previous studies (Broderick, Schwartz, Schneider, & Stone, 2009; Carlozzi, Schilling, Freedman, Kalpakjian, & Kratz, 2018; Perrot et al., 2011). This study was part of a larger study therefore the principal investigator was present in-person on most days of the program providing in-person oversight, support and reminders for participants to complete their surveys. Figure 3.1 depicts a flowchart illustrating daily data collection.

Instrument

Each day, the participants answered the same 12 questions. The survey asked questions about pain severity (0-10 scale) and perceived stress (0-10 scale). Participants reported whether they had to take any pain medication beyond their regular prescriptions, their attitudes about program components (beneficial, increased or decreased pain) and goal progress (yes or no). There were three questions about perceived social support, the type of social support and whether it was beneficial throughout the program. If participants reported that they received social support, they could choose all that applied

from these five types of social support: informational support, tangible support, esteem support, network support, and emotional support (Schaefer, Coyne, & Lazarus, 1981). The questionnaire was pilot-tested through the smartphone application on 3 participants for 5 days to ensure clarity of questions asked in the survey and to manage any technical problems with the smartphone app itself. Full questionnaire can be found in Appendix F.

Data analysis

All data were downloaded from the PACO© app website in a Microsoft Excel file and then uploaded into IBM® SPSS® software v 24.0. All data was analyzed using IBM® SPSS® v.24.0 (Amonk, NY:IBM Corp). Basic descriptive statistics were calculated to determine the participants' demographics, EMA overall compliance rates in addition to weekly, weekday and weekend compliance, and individual compliance. Frequency of received social support and the types received were calculated in addition to medication use and goal progress. Pain and stress level trajectories for all participants were graphed in Microsoft Excel (2019) to assess any trends. Attitudes regarding individual components of the program were calculated including which were considered beneficial and increased or decreased pain.

Summary

This chapter outlined the research design and methodology used to answer the research questions that were developed from the specific aims guiding this research. Chapter 4 presents the results of the analysis in the form of three distinct manuscripts.

CHAPTER 4

RESULTS

4.1 Manuscript 1

"It's opening my eyes at literally everything that I do:" the evolution of understanding and integrating the biopsychosocial model by U.S. military service members during an intensive outpatient program for persistent pain: A qualitative study.[1]

[1]Bujak, B.K., Blake, C.E., Beattie, P.B., Harrington, S., Monroe, C. To be submitted to *Pain Medicine.*

Abstract

Background: Persistent pain is one of today's most complex issues in healthcare. In the U.S. military, persistent pain affects close to half of the service members who have deployed overseas. Interdisciplinary pain management, considered one of the most effective ways to manage persistent pain, attempts to address the biopsychosocial model that illustrates the dynamic interaction between the physiological, psychological and social factors involved in the experience of persistent pain.

Objective: The purpose of this study was to gain insight into the process of change in the understanding of persistent pain through consideration of past and present experiences, psychosocial factors, personal and work relationships and stressors, attitudes, goals and future expectations of U.S. military service members attending an intensive outpatient program.

Methods: Twenty-two patient and 4 staff members were recruited and observed in an interdisciplinary intensive outpatient program (IOP) for persistent pain at a military hospital between September and December 2018. Patient participants were interviewed at the beginning, twice during the program and at the completion of the program. Staff participants were interviewed once and a researcher was a participant-observer during the group components of the program. Data was analyzed using constant comparative method using a preliminary codebook with organizational and theoretical categories. Iterative coding was completed with themes identified across all interviews addressing changes in perception of pain, attitudes, barriers and enablers, impact of past and present experiences and effectiveness of the program on future goals. Categorization of patient

participants by similarities in experience was concurrent with data collection and analysis. Staff interviews and observation notes were coded using patient participant codebook and used to triangulate the data.

Results: Five categories of participants emerged during analysis based on the observed and reported process of change: (1) participants already well-versed in many of the biopsychosocial aspects of pain, fine-tuning their skills (n=3); (2) participants with life-altering realizations changing their lives in all aspects during the program (n=6); (3) participants with partial buy-in focused more toward the physical function and performance (n=5); (4) participant with partial buy-in focused more on the psychosocial changes (n=5); and (5) participants for whom the biomedical model prevailed and despite some positive changes, the end result was seen as a failure to satisfactorily address their condition (n=3).

Conclusion: The process of change in persistent pain varied among the military service members participating in IOP with majority describing benefits such as increased physical performance, improved mood and relationships, acceptance of pain and decreased pain. Future studies should address the ongoing process of change after completion of the program and return to daily routine with a greater focus on physical demands specifically in the military population.

Key words [chronic pain, interdisciplinary pain management, experiences, qualitative analysis]

Introduction

Persistent pain is one of today's most complex issues in healthcare. It affects one in five Americans and results in nearly 600 billion dollars in lost wages and productivity (Institute of Medicine Committee on Advancing Pain Research & Education, 2011). In the U.S. military, persistent pain affects close to half of the service members who have deployed overseas, with 15 percent managing their pain with opioid medication (Toblin et al., 2014). The use of opioid medication represents an ineffective long-term pain management solution and is linked with several issues, including addiction, overdose, and pathologies such as myocardial infarction.(Chou et al., 2015; Vowles et al., 2015). Furthermore, the use of advanced imaging (i.e., MRI) in individuals with persistent pain such as back pain was shown to have significant iatrogenic consequences with medical costs up to $14,000 more per individuals compared to those who did not receive early imaging demonstrating higher costs and worse outcomes with imaging (Webster, Bauer, Choi, Cifuentes, & Pransky, 2013).

Addressing the increasing prevalence of persistent pain in the military and veteran populations, has been one of the top priorities for the Department of Defense (DoD) and Veterans Health Administration (VHA), resulting in a renewed approach to persistent pain management over the last 10 years (Office of the Army Surgeon General Pain Management Task Force, 2010). One of the implemented changes was the creation of Interdisciplinary Pain Management Centers to promote a timelier, more holistic approach to the treatment of persistent pain to improve outcomes, satisfaction, and military readiness (Office of the Army Surgeon General Pain Management Task Force, 2010).

One aspect of these centers is an intensive outpatient program that was designed on the basis of the biopsychosocial model to explain and manage this complex issue. The biopsychosocial model illustrates the dynamic interaction between the physiological, psychological and social factors involved in the experience of persistent pain (Gatchel et al., 2014; Gatchel et al., 2007). Each individual's perception of pain is based on a number of variables such as biological changes, genetics, emotions, lived experiences, as well as various social and cultural factors (Gatchel et al., 2007). Interdisciplinary intervention, considered one of the most effective ways to manage persistent pain, attempts to address the various components of persistent pain via a comprehensive approach to evaluation and treatment that involves providers from different disciplines (i.e. physiatrists, neurologists, physical and occupational therapists, chiropractors, psychologists or other behavioral health specialists, yoga instructors and massage therapists) (Gardea & Gatchel, 2000; Gatchel et al., 2014; Gatchel & Okifuji, 2006).

Despite the increasing use of the biopsychosocial model to explain and inform treatment for persistent pain, there is an ongoing need to better understand the individual experience of pain through the biopsychosocial lens, including variable responses to interdisciplinary approaches to pain management. Evidence exists for the effectiveness of interdisciplinary treatment in decreasing pain, disability, and fear of movement, as well as improving quality of life. Further, higher levels of baseline depression, nociceptive pain and older age represent predictors of responsivity to this type of treatment (Day et al., 2017; Gatchel et al., 2009; Kowal, Wilson, Geck, Henderson, & D'Eon, 2011; Kurklinsky, Perez, Lacayo, & Sletten, 2016; Townsend et al., 2008). However, these quantitative studies were limited in their ability to provide deep insights into patient

perspectives, the process of change, or lack thereof, in individuals undergoing treatment (Bruehl, 2006; Matthias et al., 2012b). A recent qualitative study in veterans assessed patient outcomes, as well as barriers and facilitators for sustaining improvement but only after completion of an interdisciplinary pain management intervention (Penney & Haro, 2019). Findings from this study revealed a spectrum among participants from those who were unmoved by the intervention to those whose whole life changed as a result of it, providing a rich perspective into the experiences of those with persistent pain that is often not captured by quantitative studies (Penney & Haro, 2019). However, to the authors' knowledge, no qualitative studies have been reported describing an active duty military population while they are receiving an interdisciplinary intervention for persistent pain. Therefore, the purpose of this qualitative study was to gain a better understanding of persistent pain from the perspective of patients and treatment staff via consideration of multiple factors, among U.S. military service members attending an intensive outpatient program grounded in the biopsychosocial model.

Methods

Setting

The interdisciplinary intensive outpatient program (IOP) for persistent pain is a full-time, 3-week treatment program with 85 hours of various group and individual therapies and education including: 10 hours of in-classroom education on pain neuroscience, sleep, medication management and goal setting; 10 hours of group behavioral therapy; 12 hours each of meditation and yoga; 6 to 8 hours of individual complementary therapy such as acupuncture, massage, and chiropractic treatments; and

over 45 hours of physical conditioning and exercise including physical readiness training, aquatic therapy, adventure therapy, group rehabilitation and circuit training, advanced exercise, and Soldier skills. On the first and last day of the program, evaluation and assessment are completed including a physical examination, various patient reported outcomes and a physical function assessment. The interdisciplinary team includes a pain physician, physiatrist, neurologist, pharmacist, acupuncturist, chiropractor, behavioral health specialist, nurse case manager, yoga instructor, massage therapist, occupational therapist, and physical therapist.

Sample Population

Participants were recruited from the IOP at Dwight D. Eisenhower Army Medical Center (DDEAMC) between September and December 2018. All participants were military service members, suffering from persistent pain who were first determined eligible for IOP by an interdisciplinary team of providers based on physical examination, medical record review and patient interview. All participants have had various treatments in the past, which included but were not limited to physical therapy, medications and interventional pain management that did not sufficiently manage symptoms resulting in a referral to the IOP by their primary care physician or a specialty clinic. Participants were recruited for the study on the first day of three consecutive cycles of IOP. An IOP staff member was present to make sure participants were free to consent or decline study participation without any repercussions or alterations in their treatment. No ombudsman was required for this study per the Army IRB. Interested participants were then given a consent form and HIPAA authorization forms to read and sign. No incentives were provided to the participants for the study. Staff members were also recruited to provide

insight on patient participants at the beginning of the research study or at various times duration of the study if they were not present at the beginning. They were presented with information about the study, the purpose of triangulation of data and staff inclusion in the study. Interested staff members were scheduled for interviews at their convenience. No incentives were provided to staff members for participating in the study.

Data Collection

Each patient and staff participant signed a consent form prior to their interview. Patient participants filled out a basic demographic information sheet including age, sex, marital status, branch of service, military rank, time in service, number of deployments, and pain duration. The rest of the data collection involved semi-structured interviews. If any of the subjects declined audio recording of the interview, the PI took copious written notes. Data from patient participants was collected at several points during the course of the program. Pre-IOP and post-IOP semi-structured interviews, lasting between 20-30 minutes, were conducted during breaks in the program or at another time and place convenient for the participant. The initial interview took place within the first two days of the program and the post-IOP interview took place on the last two days of the program. Two brief (<10 minutes) interviews were completed on the last day of the first and second weeks of IOP to ask about that week's experience and progress toward goals. The PI interviewed all patient participants. All interviews were audio recorded on 2 devices except one interview for which the patient participant declined recording. The PI took detailed notes while interviewing the participant. The interview guides were developed to prompt discussion about the understanding of pain, impact of past and present personal and professional experiences, priorities, goals and attitudes toward the program.

Questions were also asked about the participants' history of pain, past treatments and interactions with healthcare providers, perceived social support and how the pain has affected various aspects of their lives. During the program, participants were asked about their goal progress, what components were found more or less beneficial, what increased and decreased pain, how the understanding of pain and expectations for future changed as a result of the program. The question development was guided by the biopsychosocial model, conceptual model adapted from the Patient-Centered Multi-Level Personalized Patient Activation and Empowerment Framework, and IOP intervention components to improve understanding of the participants' experience and effects of the program on pain perception (Chen et al., 2016; Gatchel et al., 2007; Toye et al., 2013).

Staff participant interviews were completed using semi-structured interview guides, lasting 20-30 minutes and were conducted during breaks in the program, or another time convenient for the staff participant. The semi-structured interviews with staff participants were conducted by the PI and used for triangulation of data from patient participant interviews. The interviews addressed staff perceptions of the patient participants, group dynamics and how they affect program participation, process of change, type of patients who are most likely to benefit, and overall impression of the program.

The PI was a participant-observer during the entire program and utilized observation checklists and field notes for documentation, noting the setting, environment, delivery of the program, patient and staff interactions, patient engagement and progression in the program. Participant observation conducted during the program provided additional data to triangulate with patient and staff participant interviews. All

materials and procedures were approved by the Department of the Army Regional Health Command – Atlantic and the University of South Carolina Institutional Review Boards.

Data Analysis

All participants were assigned a unique identification number for use in this study. All interviews were transcribed verbatim by a professional service and verified by the PI. Transcription and data analysis were performed concurrently with data collection. Data were analyzed using NVivo 12 Plus qualitative analysis software (NVivo Qualitative Data Analysis Software, 2016). IBM® SPSS® v.24.0 (Amonk, NY:IBM Corp) was used to calculate descriptive statistics.

Data was analyzed using constant comparative method and the following steps were taken for credibility of findings (Strauss, 1998): (1) a preliminary codebook with organizational and theoretical categories was developed by the PI based on review of the literature, conceptual framework and clinical experience; (2) initial interview transcripts for 5 patient participant (20% of all interviews) were coded by one author using the initial codebook and additional codes were added as they emerged during the analysis in an effort to capture all insights from participants; (3) the interviews were then coded by a second coder for peer review, to assure agreement in coding technique and to gain input and additional themes and nodes that may have been overlooked. After discussion and review of the double coded interviews, an overall .73 kappa agreement of code application was calculated which is considered substantial agreement (McHugh, 2012);; (4) iterative coding was then completed for the rest of the interviews with themes identified across all interviews addressing changes in perception of pain, attitudes,

barriers and enablers, impact of past and present experiences and effectiveness of the program on future goals; (5) categorization of patient participants by similarities in experience was concurrent with data collection and analysis; (6) categorization of interviews by time; (6) staff interviews and observation notes were coded using patient participant codebook and used to triangulate the data to gain additional insight about different aspects of pain experience, group dynamics, program effects and to corroborate the findings and decrease researcher bias and reactivity from using only one methods of data collection (Maxwell, 2013); (7) matrices were created to explore the progression of biopsychosocial model understanding, functional and physical performance changes, psychosocial changes such as fear of movement, perceived social support and confidence in self-management, perceived pain changes, short and long-term goals, and future expectations during the three-week intervention.

Results

Twenty-two patient participants were recruited for the study. The majority of the respondents were male (59.1%), married (81.8%), enlisted (90.9%), in the Army (63.6%), and had not deployed overseas (59.1%). Their average age was 28.2 (7.4) and average time in service was 8.3 (6.8) years. Pain duration ranged from less than a year to 8 years (Table 1). Four staff members from the IOP were recruited and interviewed for the study. The staff participants were identified as staff only to preserve confidentiality due to the small staff size. No other identifying information was collected.

Classification of participants

Five categories of participants emerged during analysis based on the observed and reported process of change: (1) participants already well-versed in many of the biopsychosocial aspects of pain, fine-tuning their skills (n=3); (2) participants with life-altering realizations changing their lives in all aspects during the program (n=6); (3) participants with partial buy-in focused more toward the physical function and performance (n=5); (4) participants with partial buy-in focused more on the psychosocial changes (n=5); and (5) participants for whom the biomedical model, or the need to find a 'fix', prevailed and despite some positive changes, the end result was seen as a failure to satisfactorily address their condition (n=3). Each category of participants is described in more detail next and Table 2 summarizes the process of change for each group.

(1) Fine-tuning skills (n=3)

Each participant had pain for well over a year, had seen various providers and specialties, learned about persistent pain from others or independent research and attempted various self-management techniques, some successful and others less so. By the end of the program, each of the participants reported at least some improvement or reinforcement in understanding of the biopsychosocial model or some component of it even though they already reported knowledge and understanding prior to the program: *"The explanations that I have got up until this point have kind of helped me to kind of understanding why it's happening the way it is. So I haven't been presented any new information"* (participant 63-8).

They were also already physically active at the start of the program, indicating fear of movement was much lower than others in the program. When observed by the researcher, the participants were knowledgeable on how to perform most exercises correctly but still reported gaining insight into perfecting form and understanding which exercises may be better for them and how to progress properly. Despite higher functional level at the beginning of the program, these participants also made progress and improved on the physical performance testing by the end of the program: *"Within the three weeks, my physical function has gone up. I've made improvements on everything for the metrics"* (participant 63-8).

Consequently, confidence in pain management, self-management skills and progression of exercises improved for all three. Pain level decreased at rest and with most activities for 2 participants and no changes were noted by the third participant who was not surprised her pain did not change significantly because she has dealt with it for 8 years which was much longer than the average program participant. One of the participants whose pain decreased reported satisfaction with the program on all fronts: *"So I came in with pain. Now, I'm leaving with less pain. I feel a lot better, I feel a little more motivated and hopeful that I can continue making progress toward getting back to where I wanna be"* (participant 63-8).

Each participant came to the program with specific goals such as a running goal, a weightlifting goal or a push-up goal. The focus was on improving physical performance and function, not psychosocial components. However, each participant did report behavioral and emotional takeaways after the program. Negative emotions,

catastrophizing and anger were identified as contributors to pain and were added as future expectations to work on:

> *"I understand that your brain has a really big impact, especially on how you interpret that pain. If you interpret it as a, 'This is gonna end the day. This is gonna be horrible.' Or if you just say, 'Alright, I'm in pain. How do we deal with it? How do we get through it?' kind of thing. So it's just made me, I guess, a little bit more positive about my pain, not so negative."* (participant 61-1).

All three participants had support from supervisors to attend the program without any distractions. Two participants reported satisfactory relationships with family and friends but did report social isolation due to pain by declining going out to eat or performing leisure activities. One participant was not allowing pain to affect the relationships with his spouse and his children but had to be careful when playing with his young children. By the end of the program, he reported satisfaction due to the ability to pick up his child without pain:*"Being able to pick up my kids again is nice, but it really didn't change [my relationship with them]"* (participant 61-3).

(2) Life-altering realization (n=6)

Participants who gained the most out of IOP developed a deep understanding of the biopsychosocial model for persistent pain, the connection between the body, brain and the interaction with psychological and social aspects of their lives. Various behavioral health methods, meditation, breathing techniques, pain and sleep education were voiced as beneficial and brought additional understanding to the experience of pain in these individuals. The participants in this category were very open-minded and willing

to try various self-management skills and coping mechanisms that were introduced. They did not voice skepticism even if by the end they decided not to use certain methods they learned and did not find the methods useful. One participant felt empowered with the ability to manage her condition after the program:

> *"I'm much, much more confident...before I came to this program, I was in the mindset of, "If they want to throw a [medical evaluation board], I'll take it." Even with me only being a year [in the military]. But now I just know I can improve myself. There's nothing that can't stop. If that was the case, then I'd still be in pain now, which I have seen the things that the program has shown me have helped me, so I'm much more confident that I can help myself instead of needing to go to the emergency room, or, "I can't do this," or, "I need a profile." I'm able to go out and do things that I wanted to do before"* (participant 62-4).

Another participant summarized the best approach when coming into the program to maximize outcomes:

> *"Go in with an open mind and remember, don't [complain] about it. Just go in there and it's for your own good. You're in it for a reason. It's not like anybody held you at gunpoint and told you to go into it, so get what you can out of it and get the most of it and be open because if you go in thinking that you're probably too good for it or you shouldn't be doing this or anything like that. You just don't need to be, so I would just say, 'Do the best you can and take in everything you can and just do everything at your best'"* (participant 61-2).

These participants expressed a decrease in fear of movement and reinjury as a result of the stress-free and safe setting in which they were gradually pushing themselves to increase physical activity. The program staff who appropriately modified, progressed the exercises, and pushed the participants to and through their limits overwhelmingly were considered the principal motivators in the program:

> *"The staff treated everybody with respect, with dignity. But they definitely didn't let nobody not do anything, which was awesome. Because it's too easy to be like, "You know what, I'm not doing anything, I hurt." And the staff didn't allow that, and I thought that was pretty awesome. So everything about this course I enjoyed. I really did"* (participant 62-1).

One participant recognized he had kinesiophobia prior to the program and the program was helping him change his mindset:

> *"It's definitely changed a lot. Coming into the program, I had a little bit of that kinesiophobia going on. It had been a while since I worked out because the past several times I worked out it was pretty painful. Then coming into this program is this rush of doing a lot more than I was used to, or had been in the past few months. I was really sore, but it was helping my pain level go down. That's been the trend throughout the whole thing. I feel like my pain is getting a little bit less. Some days it's about the same as it was, but I'm doing 10, 20 times more than I was before, which has been a really good experience"* (participant 63-1).

During the program, the participants made great strides in activities of daily living, reporting improved function and increased energy at home, positive interactions

with families and friends and decreased social isolation. This surprised many of them as they learned they were able to perform at a higher level than they were expecting when they were starting the program. One participant reported more enjoyment in playing with her children and cooking due to the progress she had made in the program:

> *"Even going home, I feel like I have more energy and more patience with my kids and I can actually want to play with them, and not feel like I'm going to be able to sit on the floor for so long, before my hip starts hurting and I have to get up and walk around. And then just everyday things that I've done before, like I will cook dinner, 'cause I cook a lot, I cook almost every day when I can, and when I have time. But when I cook, I'll be standing in the kitchen obviously, and my hip will hurt. That's actually not happened in a couple of days, so I feel it still there a little bit, but it is slowly going away, 'cause maybe my hip is getting stronger and those muscles are being worked so they're less stiff and stuff, as far as I know. I think the behavioral health sessions have helped me, before I didn't really think it affected my home life or relationship, or with my kids or anything like that. Maybe small things, but it just helped me gain a different perspective on how maybe it was affecting it and I didn't even realize it, so that's good"* (participant 61-2).

Another participant also reported increased function at home:

> *"I've been doing more at home, even at home working out, and at home doing more with my son and doing stuff around the house, putting stuff up in the attic, stuff like that that I wasn't really doing before"* (participant 63-1).

Relationships with families were described as mostly positive even at the start of the program and all except one participant reported they actively attempted to decrease the effect of pain on their families by trying to prevent negative interactions such as foul mood or irritability. One participant had a realization during the behavioral health sessions that she had been treating her family poorly and reported apologizing to family in addition improving communication about her pain:

> *"But I will definitely have a conversation with her to try to explain to her, 'Well, this is what's going on, and this is why.' And now I'm in a different mindset so I'm going to help myself. I'm not mean anymore. I apologized even, I didn't realize how mean I was being to people"* (participant 62-4).

The combination of progressive physical activity and reassurance by the providers was aided by the cognitive components which addressed the need for a decrease in catastrophizing, ruminating and negative thoughts. These participants increased their own levels of expectations while in the program as they became more confident, pushing negative thoughts aside and pushing beyond their own limits they thought they had. As a result, at the end of the program, all reported a decrease in pain intensity at rest and with some or all of the activities and exercises. Those that felt their pain did not change as much or still increased with certain activities, recognized that they were much more active than prior to the program, and therefore, they still cited success due to decreased disability while accepting the presence of persistent pain:

> *"I'm not even looking 'oh I need to fix this, I need to get to 100%,' no, you got these little things that we can dwindle down, but you can still be as great or*

greater than you were before. So that's what I'm definitely seeing IOP has done for me, it really changed my mentality. It's like not everything can be fixed, but you can still do right. You can still excel. You can still achieve" (participant 63-5).

The participants in this group, set specific and realistic goals from before, during, and after the program. Plans for continuing self-management and exercise progression were clearly laid out at the end of IOP with some participant already creating a weekly schedule. This is consistent with what was reported by IOP staff who stated that participants who set clear goals throughout the program tended to perform well during it and experience successful outcomes:

"Someone that sets realistic goals in the beginning and meets those goals…Specific measurable, obtainable, realistic, and time-oriented. If they are that, and they do it, and they put forth their effort, don't reinjure themselves, they're usually really pretty good" (staff participant 4).

Five of the 6 participants in this group reported support from their supervisors and co-workers to attend this program. Knowing this, the participants could give their full attention to IOP without work-related interruptions. One participant reported a stressful and unsupportive work environment and was ready to begin the process for a medical discharge from the military because of her persistent pain; however, she changed her mind after completing IOP and had renewed hope to continue military service in the new unit she was moving to:

"I'm more motivated, so I think it's going to help me to be able to go, especially with me going to a different company. When I leave out of here, I'm going to hit it head on, give it my all…I'm going to give them 110% of myself with a positive attitude" (participant 62-4).

Experience with previous healthcare providers and treatment was mixed. Two individuals reported pain for over 8 years, one reported pain duration for less than a year, and the others reported experiencing pain between 2 and 8 years. Thus, the degree and variety of care prior to this program was expectedly wide-ranging. One participant reported regret and frustration that he did not know about the program earlier because he had been on opioid medications for his pain without success for several years. He expressed disappointment that the healthcare providers and pain specialists he had seen over the years never mentioned this type of treatment program until recently when he was finally referred to IOP:

"[I wish I had this] a long time ago. Especially for a simple fact, for three year I was just given hydrocodone. So definitely before that epidemic started, I wished this program would have been thrown at me. No telling what position I would be in right now" (participant 62-1).

The satisfaction with the program was overwhelmingly positive and outcomes were reported as better than expected. No displeasure with the program treatment or staff was noted among the participants.

(3) Physical performance improvement focused (n=5)

This subset of participants also made great strides in the program but focused more on the improvement of physical function and performance which was reflected in the goals such as returning to running, weightlifting or simply being able to pass the military physical fitness test. One participant had a specific goal for weightlifting: *"I would like to be able to squat with one plate again without pain and if I could do that…that was my end term goal. If I walk out and I can do that, alright. It's all been worth it" (participant 62-6).*

The participants focused on the physical changes but they did note changes in thought processes such as a decrease in fear of movement and reinjury. These participants came to the program with the expectation to learn exercises they could perform without hurting themselves further because for many it was a long time since they physically exerted themselves: *"I want to see what my body can actually do in a safe environment. I honestly don't know what I can and cannot do anymore. So, with this I'm hoping that I can actually get a baseline for myself and they can teach me how to help myself"* (participant 62-7).

Significant skepticism toward using the program's behavioral techniques to manage pain was observed by the researcher in this group of participants. Majority reported that they did not find meditation or any of the behavioral techniques such as deep breathing or relaxation techniques: *"The behavioral health class with a social worker, it has really good points. I don't personally like some of them, but it might work for somebody else"* (participant 62-7). However, by the end of the program, each of the

participants found something that pertained to his or her individual situation whether it was the realization that pain was affecting their relationships and attitudes or that they accepted the importance of understanding and addressing the psychosocial connection with pain. One participant stated: *"I guess like your state of mind is important to how you perceive pain, whether you're willing to work through it or not and what your motivation level is"* (participant 63-8). Another participant stated: *"I guess I was always aware there was a big mental side. I guess I didn't realize just how deeply it ran"* (participant 62-6). A third participant made plans to schedule individual behavioral health sessions after the completion of IOP: *"I've also got a consultation with behavioral health to help with that as well because if there's one thing I've learned in this class, the mental part is going to help or hinder the rest"* (participant 62-7).

A reduction in negativity and irritability with corresponding improvement in relationships with spouses and children were benefits noted by 3 participants who recognized the connection between pain and affect. Improved physical function around the home was also appealing to the spouses and children. One participant reported: *"My wife is happier with me (laughs)…It's nice not to have her say I'm moody all the time and I wanna spend more time doing stuff with my sons"* (participant 63-6).

All but one participant in this group felt they had support from their supervisors to attend the program and were not concerned about work while in the program. One participant reported negative perceptions from co-workers and was hopeful this program would improve her physical function to pass her fitness test and not be looked down upon: *I was on [limiting duty] profile, when you're on profile, they don't believe what*

you're saying, that you're lying. People's perception takes a toll on you. I'm already a single mom. I don't want to be the person with the problems" (participant 63-2).

In this group, there were participants whose pain decreased even with increased activity but there were also others whose pain did not change or continued intermittently. The participants with decreased pain were more satisfied while those who continued to have higher levels of pain expressed some disappointment but still felt the program was very successful for them: *"While my pain hasn't gotten any better, it might have gotten a little worse, but I know how to handle it better"* (participant 62-7).

Confidence in self-management after the program was expressed mainly in the knowledge of proper body mechanics and progression of activity and exercise to improve physical fitness and performance. The participants felt they could manage their pain by the changes they made in physical function and not necessarily the psychosocial aspects. One participant reported enthusiasm over learning proper lifting technique: *"The lifting class, proper lifting, I actually did not realize how much weight goes onto your [neck], or pressure on your back when you don't lift properly, so I gotta try to keep that in mind all the time"* (participant 63-6).

The post-program plans and goals were also associated with including specific exercises, functional movements in daily routines and an overall increase in activity, with each participant listing specific activities and probable schedules. Two participants reported immediate plans to continue working on running form, while others reported a goal of a more consistent schedule for physical training: *"[Physical training] regularly.*

We did some workout stuff with [IOP staff], yesterday, and it's stuff I already have at home, so it's things that I can do" (participant 63-4).

(4) Psychosocial improvement focused (n=5)

The five participants in this category indicated greater focus on psychosocial aspects of their pain with a transformation of mindset and understanding of the impact of pain on relationships, personal emotions and daily function. An appreciation for behavioral health components of IOP was most apparent in this group:

> *"So, with the behavioral health it was what helped me the most, learning how I may act because of my pain, learning how other people see my pain, and learning what I can do to not let my pain interfere with the rest of my life"* (participant 61-5).

Meditation, relaxation methods, reducing negative emotions, improving coping skills and acceptance of pain were key takeaways from the program for these participants. One participant summed up the change from her 'can't do' to a 'can do' attitude:

> *"I think when we're talking about behavioral health with the kinesiophobia, that was 100% me. I was like, "Well, if I do this, then I'm going to hurt," so I really limited myself to activities that were my strength. It's given me the ability to understand that I'm okay, and that for the most part it's temporary. If I go above and beyond, then maybe I'll be sore for the day, but ultimately it's going to go away. I'm going to be able to manage it. That's been good, to understand that it's not forever"* (participant 62-3).

Another participant found some of the behavioral techniques to be effective self-management tools and was planning to continue using them in the long-term:

> "*Meditation. I try to go walk pretty often, run when I can on the weekends and just practicing staying positive. I plan to not put as much on myself, try to moderate everything, utilize the different techniques that we learned as far as stretching and rolling, and things like that, so I'm not injuring myself. Body mechanics and breathing techniques, all of which I mentioned"* (participant 61-4).

Other post-program goals and expectations centered on being in a better mood or less irritable with a spouse, decreasing social isolation, improving function not necessarily related to military fitness, and communicating about pain more effectively. One participant discussed reducing negative emotions in her life:

> *"Just being able to go play tennis with my mom or go on a walk with my mom has been good, and not taking out my pain and frustration on my husband because... easy target. Being able to shift to the positives, that's something that I think a lot of people say, from the behavioral health component, changing your focus"* (participant 62-3).

Physical performance improvement was not as apparent in this group of participants for several reasons. Two participants had multiple sites of pain or acute injuries that were not necessarily part of their persistent pain. Nevertheless, these factors were limiting what the participants could perform while in the program and subsequently inhibited their progress. The other 3 participants did not complain of additional physical

issues but due to a prolonged lack of exercise (i.e., no running in at least a year), they lacked endurance, which inhibited their physical performance:

> *"Some of the exercises, in the morning definitely when we do all the push-ups and everything, I haven't done anything in a while so my muscles got tired really fast. That was kinda the problem…my pain level has gone up and down over the past couple weeks, simply from not doing any type of active exercise for the past couple years, and I guess my body's just trying to get used to it again"* (participant 61-5).

Fear of movement and reinjury decreased for all participants as they reported functional improvements with daily and social activities. Some level of apprehension and ongoing reluctance with the physical exercise components continued and these participants were quick to modify or stop exercise, accepting that they may not be able to perform more advanced exercises:

> *"Before, I felt like I couldn't really do anything, which was kind of depressing. I'm in the Air Force, I should be able to do fitness stuff, and just felt I couldn't do anything. But now, I might not be able to do exactly what I want, but I can modify it so that it works with my body, and I'm still doing something"* (participant 62-5).

Motivation to return to a higher level of physical performance was less obvious among these participants. One of them reported that his function at home improved as did his score on physical performance testing; however, the latter still caused increased pain: "*I guess if there was a change I can now do more things with my son and husband. I can be active. I can cook more, clean more"* (participant 61-5). When probed further about

exercise after the program, he stated he lacked social support and self-motivation to continue: *"I can't do it for myself. It's just not going to work"* (participant 61-5).

None of the participants noted a significant decrease in pain level by the end of the program and all had frequent increases in pain throughout the program caused by the various exercise classes, citing this as one of the reasons for the slower progression. This group also felt no need to push through pain or push their limits. One participant stated:

> *"That's been really important for me to grasp, because I've been so used to just sucking it up and dealing with [the pain]. Taking that into the future and understanding that I don't have to give- it's not all or nothing. I can do as much as I can do and then build upon that so that's been really good to realize"* (participant 62-3).

Acknowledging spouses or other family and friends was common for this group of participants. When assessing personal progress in the program and setting future goals and expectations, all participants included important people in their lives as they were discussing positive changes and plans for self-management. One participant was very enthusiastic about how the program affected her family life:

> *"Because this program I actually feel confident to go do certain stuff that I thought I couldn't do. I was scared to go play basketball and hurt myself or ... because I like to do sports, but now I feel like I can do it. I can do stuff with my family that ... we been trying to do paintball for very 'longish' and I keep telling my wife that I don't feel like doing it because I don't feel like moving around, but I can do that now. I can move stuff for my family. If she wants to move stuff around*

in the room. Help her out. Yeah, also at work, I can ... because we do a lot of sitting and my job sometimes I have to move some stuff. Yeah, I feel like I'm going to do better" (participant 63-9)

Support from supervisors was less obvious in this group. One participant was rescheduled for IOP several times due to work obligations and a supervisor's request. Another was contacted by her unit several times to return to work for various tasks even though she was officially released from the unit for the entire three weeks, adding stress and frustration for the participant. There was general uneasiness among participants about returning to military duty and being able to perform physically because at the completion of the program they still had a long road ahead to improve their physical performance: *"It's difficult thing to deal with when you're in the military and so much of your identity is wrapped around your physical fitness"* (participant 62-3).

(5) Biomedical model prevails (n=3)

Three participants considered the outcome of the program to be less than satisfactory. From the beginning to the end of the program, participants focused on the need to 'fix their pain" rather than taking ownership of improving their life with acceptance of pain, coping and self-management. Each one explained their condition with biomedical terminology, did not appear to make the connection with psychosocial components and demonstrated disappointment when the pain did not subside. One participant stated:

"My understanding of pain is I'm gonna probably…I keep telling myself it's gonna get better when I start working, because I'll be more active, but part of me

is like, 'This is how you're gonna live for the rest of your life.' So it's hard to accept that" (participant 63-3).

A staff member from the program had similar insights. Participants with unsatisfactory outcomes are usually those who look for a concrete resolution rather than management of their pain and this perception does not change after IOP. She said:

> *"Service members who think that there is something that still needs to be fixed. The 'I have a diagnosis that I need a fix for' seem to do the worst in the program, because they are still looking for a medical cure or medical fix versus improving their actual physical function with the limitations of their injury*" (staff participant 3)

These participants regressed or did not make improvements on the physical performance assessment. Pain intensity fluctuated throughout the program with all participants reporting increased pain during the exercise sessions and no change or an increase in pain by the end of the program. One participant reported increased pain and decreased performance: *"So, at least what I noticed, at first I could do more pushups and now I feel like I can't, it's more intense pain"* (participant 61-6).

None of these participants reported clear and specific goals and plans for continued self-management for after the program. Lack of confidence in self-management, performing work duties and functioning at home were expressed as well. One participant was noncommittal with self-management plans and all 3 had plans to request additional visits for some of the passive treatments they found beneficial. He stated: *"I think I can self-manage some things, I do like acupuncture so I'm going to*

request that today, I guess time will tell right? We will see how it goes" (participant 62-2).

Another participant also focused on utilizing passive treatment methods with no significant enthusiasm toward the active self-management techniques she had learned:

> *"The chiropractor is definitely…I've always been going to chiropractors since I've been younger. Masseuse, I've always done that. So I'm gonna still continue those things...I'm gonna try to do yoga. I hate lifting, but I'll try to lift"* (participant 63-3).

Two of the 3 participants had strained relationships at work. At home, the participants relied on their spouses to perform many functions because of pain and self-perception that any increased activity will increase pain or cause more injury:

> *"…she stays home with the kids, right, so I think she's more understanding and she helps out more because she doesn't have a 9 to 5 [job]. I don't feel like I'm overwhelming her because I think she has time that she can help me out"* (participant 62-2).

Fear of movement and reinjury changes were not obvious in this group. One participant specifically reported that when she was moderately active while in the program, her pain decreased for the rest of the day, but she did not carry that over into a future goal to be active daily after the program to help manage her pain. She reported that once she returns to her unit, she does not plan to do physical training with her unit or perform alternate exercise: *"I'll probably end up going to sleep after formation. I'm not gonna lie"* (participant 63-3).

On the weekends during the program, the participants reported planning fewer or no specific activities based on what they learned compared to many of their peers in the program. They also reported not using many of the self-management skills outside of the program consistently. When asked about using any of the skills learned outside of the program, one participant reported: *"[I] just lay in bed and watch Netflix and go to sleep…I feel like I've done enough in one day. The body needs to relax at one point"* (participant 63-3).

All participants reported dissatisfaction with previous healthcare providers. Any previous treatment that was reported as successful included either medications or passive techniques such as chiropractor treatments or massage. All three participants reported previous physical therapy or home exercise programs as ineffective for their persistent pain. Satisfaction with IOP was also less enthusiastic than participants who were in the other categories. One participant was more dissatisfied with the program than others and would have preferred to have a more individualized treatment plan: *"I think maybe like a tailored workout plan or nutrition plan. Right? So, we've been doing a lot of group stuff, which is great, but we all have different injuries. Right? So maybe some individual assessment"* (participant 62-2).

Lastly, while these participants reported the program to be beneficial for persistent pain and that they would recommend it to others, they felt that the program did not improve their current state of pain.

Discussion

The interdisciplinary IOP for persistent pain was observed to be beneficial for most military service members. Everyone reported gaining at least some benefit out of the program. Participants who came into the program with knowledge and understanding of the biopsychosocial model of pain still saw benefit in attending by fine tuning their knowledge and functional skills. Most benefit was reported by the participants who came to the program with no significant knowledge about persistent pain but with an open mind toward all aspects of the intervention, motivation to make changes in their personal and professional lives, and in good physical condition. Participants more focused on improving physical performance tended to show more skepticism toward the behavioral and mental components of the treatment program. While skepticism may have been present at the beginning of the program in participants across the emergent categories, it was more pronounced throughout the program in the physical performance focused group. Participants more focused on their psychosocial wellbeing, noted greater understanding and acceptance of pain, improvements in relationships and usefulness of behavioral techniques to managing their pain. These participants made less progress in physical performance and reported greater uncertainty about returning to work. Least overall benefit was noted by the participants for whom the biomedical model, or the need to find a fix or cure for their persistent pain prevailed. These participants reported greatest relief from passive treatments such as chiropractic treatment, massage, or acupuncture, while dismissing active treatments (i.e., weightlifting, aquatic-based exercise, yoga) as painful and not beneficial.

To our knowledge, this was the first study to qualitatively explore the process of change in the understanding of persistent pain, psychosocial wellbeing and physical performance through consideration of past and present experiences, personal and work relationships and stressors, attitudes, goals and future expectations of U.S. military service members while engaging an intensive outpatient program. The military is a unique population which demands a high level of physical fitness as part of the job requirement compared to most civilian occupations. Service members in the program were pushed well-above their comfort zones and performed activities with much higher physical demand, something that may not be the focus in civilian pain programs. However, this study's findings are significant for both military and non-military populations because we found that meaningful changes can take place in as little as 3 weeks for a highly variable group of individuals who have had persistent pain for many years and a variety of symptoms and experiences. This interdisciplinary intervention utilized the biopsychosocial model for understanding and management of pain and was effective for majority of the participants regardless of where they started on the continuum of knowledge or function. Those who gained most benefit, demonstrated improvement in physical performance and were also more open to and more likely to apply cognitive-behavioral techniques for self-management and acceptance while in the program. These participants were able to take all of the information learned and create a plan to integrate and carry out in their lives after completion of the intervention.

The program was standardized and everyone received the same dosage of the intervention. This demonstrates that while it is important to individualize patient treatment, this setting may provide a group dynamic that can be beneficial as

participants are working on making personal changes. Overall, participants reported high satisfaction with the program and receiving sufficient attention individually even though the majority of the treatment was group-based. Future research should explore how group dynamics affect participation in an intensive outpatient program.

The program had less successful outcomes for some of the participants. Job satisfaction and workplace physical factors were found to have an impact on return to work in individuals with persistent pain in previous non-military studies and likely had an impact in our participants and their motivation to improve or simply report improvement (Fishbain, Cutler, Rosomoff, Khalil, & Steele-Rosomoff, 1997; Steenstra et al., 2017; Teasell & Bombardier, 2001). Lack of improvement from treatment and ongoing limiting duty profiles can be a secondary gain for some service members, especially those with low job satisfaction or higher than desired physical demands because it often leads to a medical evaluation board determining whether a service member should remain in the military or be medically discharged. Most service members who attend IOP are at a crossroads in their military career and the program is their last resort to get better in order to stay in the military, while for others it may simply be a 'check the box' step before a medical evaluation board is initiated after all treatment options have been exhausted.

Skepticism toward the behavioral health components of the interdisciplinary intervention was anticipated in at least a portion of our sample for a couple reasons. Frequently, individuals with persistent pain feel that their providers do not believe their symptoms and think the pain is 'in their head.' Therefore, when presented with behavioral and cognitive explanations and methods to help manage pain, these individuals see it as yet another provider telling them that their pain is not real, causing

initial suspicion, push-back or frustration. The skepticism also aligned with a general stigma toward any mental and behavioral health service in the military. The common perception among service members is that seeking behavioral health treatment leads to being viewed differently by leadership and peers and for some, even more importantly, the possibility of rejection from a sought out job opportunity despite the attempt by the military to dispel some of these myths (Ben-Zeev et al., 2012; Green-Shortridge, 2007; Sharp et al., 2015). In our study, by the end of the IOP, even the most skeptical participants reported at least some benefit from the behavioral health sessions and several also scheduled additional individual appointments to see the behavioral health specialist after completion of the program. The participants who stated the techniques were not applicable to them and did not make a direct connection with their persistent pain, reported they could see how the behavioral methods could be useful for others and found some of the discussions informative even if they were reluctant to state anything applied to them directly. These findings are consistent with a previous study in the military population that demonstrated a decreased utilization of emergency care services but increase in utilization of behavioral health after a functional restoration program similar to the IOP (Gatchel et al., 2009).

Some gender differences were observed with male participants placing more emphasis on improvement in physical performance but with increased skepticism toward the mental health components in IOP. Female participants appeared to resonate more with the psychosocial components, were less incredulous and demonstrated increased comfort with making connections between mental health and persistent pain. Previous research has shown that, females are more willing to seek mental health services due to

positive attitude toward psychological openness compared to males (Mackenzie, Gekoski, & Knox, 2006). The females attending IOP were observed to open up more quickly and frequently throughout the program while some of the male service members spent more time as observers rather than participants in the behavioral health sessions. Additional methods may be effective and should to be explored for improving understanding and acceptance of mental health services in those with persistent pain.

Through participant narrative and observed behavior, this study also unexpectedly found that participants did not have a good grasp of basic functional movements, such as squats, proper lifting techniques and body mechanics, despite the fact that most of the participants performed regular physical training. Participants who have been in the military for several years reported learning how to properly perform movements and exercises for the first time during this program. This is critical information as the military continues to struggle with musculoskeletal injuries from job-related incidents or improper training. In the Army alone, 50% of Soldiers are diagnosed with musculoskeletal injuries annually and more than half are due to lower extremity training injuries suggesting an ongoing need for better training across the military and not only those already injured or in pain (U.S. Army Surgeon General Report, 2016).

There were a number of limitations of this study. The sample size was from a small subset of the military population which may not be generalizable to non-military populations or all other military occupations. Participants in our study had similar, mostly sedentary jobs while the more physically demanding jobs such as combat arms were not represented due to the location of the program. There was no long-term follow-up to determine the implications of the program after return to work. The long-term process to

return to the required level of physical ability, which is an imperative factor in military readiness, should be further explored because while the majority of IOP participants made progress in the program, few were ready to return to full duty without any limitations immediately after the program. In a study of veterans who completed an interdisciplinary intervention, the barriers and challenges included lack of ongoing support and motivation to continue self-management which may be similar to our study's active duty population but returning to military duty presents additional challenges and demands especially physical fitness and performance which should be explored (Penney 2019). We also did not follow participants to determine whether they stayed in the military or were medically discharged. Future research should address the participants' experiences after return to full duty to determine the skills and techniques from the program that were found to be more or less feasible and whether participants continued military service.

Conclusion

The process of change in persistent pain varied among the military service members participating in IOP with the majority describing benefits such as increased physical performance, improved mood and relationships, acceptance of pain and decreased pain. Open-minded individuals reported greater changes in all aspects of pain while those focused on finding a resolution to their pain reported the least benefit. Future studies should address the ongoing process of change after completion of the program and return to daily routine, including a focus on physical demands inherent within the military population.

Table 4.1. Demographic characteristics of the sample (n=22)

Indicator	Fine-tuning skills (n=3) (N)%	Life-altering realization (n=6)	Physical performance improvement focused (n=5)	Psychosocial improvement (n=5)	Biomedical model prevails (n=3)	Total sample (n=22) (N)% or Mean (SD)
Age	26.0 (3.0)	30.7 (11.6)	31.4 (5.8)	23.6 (1.8)	28.0 (7.5)	28.2 (7.4)
Time in service	6.3 (2.1)	8.8 (10.3)	12.0 (5.5)	4.4 (1.5)	9.3 (8.1)	8.27 (6.8)
Pain duration	5.0 (4.2)	3.6 (3.9)	4.2 (2.9)	2.4 (1.1)	4.0 (2.6)	3.7 (2.8)
Pain at start of IOP*	4.3 (1.5)	6.0 (1.5)	4.8 (1.6)	4.8 (1.8)	5.7 (1.5)	5.2 (1.6)
Pain at end of IOP*	3.0 (1.0)	4.5 (2.9)	4.0 (2.3)	4.4 (1.5)	6.0 (2.0)	4.4 (2.2)
Gender						
Male	(2) 66.7%	(4) 66.7%	(3) 60.0%	(2) 40.0%	(2) 66.7%	(13) 59.1%
Female	(1) 33.3%	(2) 33.3%	(2) 40.0%	(3) 60.0%	(1) 33.3%	(9) 40.9%
Military Component						
Army[1]	(1) 33.3%	(5) 83.3%	(2) 40.0%	(4) 80.0%	(2) 66.7%	(15) 68.1%
Air Force	(1) 33.3%	(1) 16.7%	(2) 40.0%	(1) 20.0%	(1) 33.3%	(5) 22.7%
Navy	(1) 33.3%	(0) 0%	(1) 20.0%			(2) 9.1%
Military Rank						
Enlisted	(3) 100.0%	(5) 83.3%	(5) 100.0%	(5) 100.0%	(2) 66.7%	(20) 90.9%
Officer[2]	(0) 0.0%	(1) 16.7%	(0) 0.0%	(0) 0.0%	(1) 33.3%	(2) 9.1%
Marital Status						
Married	(3) 100.0%	(4) 66.7%	(3) 60.0%	(5) 100.0%	(3) 100.0%	(18) 81.8%
Single[3]	(0) 0.0%	(2) 33.3%	(2) 40.0%	(0) 0.0%	(0) 0.0%	(4) 18.1%
No deployments	(2) 66.7%	(4) 66.7%	(1) 20.0%	(4) 80.0%	(2) 66.7%	(13) 59.1%

*0-10 pain scale; [1]Army, Army Reserve; [2]warrant officers; [3]single and divorced

Table 4.2. Categorization of participants and summarized process of change during IOP.

Group Category	Beginning of intervention	During intervention	End of intervention
Fine-tuning skills (n=3)	Good understanding of biopsychosocial model, fairly active, ongoing pain; would like to find additional tools to self-manage pain and keep moving forward	Improved understanding of persistent pain, lingering questions answered, self-awareness of errors in thinking, practicing positive attitude, decreased apprehension with daily routine and increased energy and motivation at home	Decrease or no change in pain, full integration of the biopsychosocial model, new skills to manage pain with exercise and behavioral methods, improved form and quality of physical exercise, decreased social isolation
Life-altering realization (n=6)	Open-minded individuals, some knowledge and understanding of pain but not fully developed, ready to try all treatment options (physical and behavioral-cognitive), highly motivated to stay in the military	Integrating all components of pain including sleep, stress, mood, and exercise, breaking through kinesiophobia, actively incorporating skills daily, increased energy at home, everyday tasks easier, more patience with children, increased mobility, flexibility, strength	Decreased pain, full integration of the biopsychosocial model, increased confidence in self-management with both exercise and behavioral methods, improved energy, family life, physical performance; plans to take military fitness test
Physical performance improvement focused (n=5)	Moderately active participants or inactive but strongly motivated to increase physical fitness to stay in the military with main goals to pass military fitness test	Some improvement in understanding of pain, struggle to accept pain, decreasing fear of movement, some use of self-management skills, less likely to use behavioral skills, focus on exercise progression, improving body mechanics and posture	Decrease or no change in pain, increased confidence in self-management with physical exercise progression, understand psychosocial components but minimal plans to use behavioral methods, goals centered around exercise, plans to take military fitness test

Psychosocial improvement focused (n=5)	Low or very low activity level, motivated to improve function and quality of life but not necessarily to push through pain or return to full military duty, multiple sites of pain and additional more acute comorbidities	Improved understanding of the psychosocial aspects: effect on mood, thoughts, relationships; learning to accept and cope with pain, quick to modify or stop exercise due to pain, minimal or no progression with performance, decreased social isolation, improved quality time spent with family and friends, practice reducing negativity	Decrease or no change in pain, increased confidence in self-management using behavioral methods more than exercise; improved mood, family relationships and daily function, minimal or no physical performance changes
Biomedical model prevailed (n=3)	Focus on the biomedical diagnosis and the need to figure out how to 'fix' the problem and eliminate pain, low or no consistent physical activity	Some understanding of the individual components of the biopsychosocial model but no application to own pain, continue to see pain as a limiting factor in improving quality of life, no consistent self-management, perceived worsening of pain and function	No change or increased pain; limited confidence in ability to self-manage, lack of full integration of biopsychosocial model; overall limited benefit from the program; planning to continue passive treatments for pain; struggling to accept pain, future goals less specific

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4.2 Manuscript 2

A three-week, interdisciplinary intensive outpatient program for persistent pain is associated with increases in the Patient Activation Measure scores and key outcome measures in U.S. military service members.[2]

[2]Bujak, B.K., Blake, C.E., Beattie, P.B., Harrington, S., Monroe, C. Wilkie, D., Earwood, M., Meddings, M. To be submitted to *Pain Management.*

Abstract

Background: Being actively engaged in one's own health care is associated with improved outcomes. The U.S. military has developed an interdisciplinary intensive outpatient program to help participants understand and improve knowledge about their persistent pain and to learn how to become advocates in their own care while actively managing their symptoms. The effectiveness of this program has not however been clearly defined. The Patient Activation Measure (PAM) has been shown to yield valid measures regarding the level of knowledge, skill and confidence in managing one's own health and can be a valuable tool to address the effectiveness of these programs.

Objective: To examine the change in the Patient Activation Measure and assess its relationship with measures of fear of movement, pain intensity, pain interference, and physical function assessment in an intensive outpatient program (IOP) for military service members with persistent pain.

Methods: Retrospective data was obtained from individuals who participated in an IOP for persistent pain at a military pain management center from January 2017 through August 2018. Pre and post-intervention measures included: The Patient Activation Measure-13 (PAM-13), Defense and Veterans Pain Rating Scale (DVPRS), Tampa Scale for Kinesiophobia-17 (TSK-17), and physical function assessment which included 1-minute of push-ups, deadlift and a shuttle run. Paired t-tests and Spearman rank correlation were computed to assess changes pre to post-program and relationships of PAM-13 with the other outcome measures.

Results: The study included 105 participants (70.5% male), majority were enlisted (95.2%), deployed overseas at least once (51.4%), did not use tobacco products (81.9%),

and did not attend any behavioral health treatment at onset of IOP (86.7%). The average age of participants was 29.02 years and pain duration was 56.68 months. The average patient activation score increased from level 3 (59.51, SD=14.13) to level 4 (69.67, SD=16.50). The TSK-17 score for the entire sample decreased by 4.44 points to 35.63, below the commonly used cut-off score of 37. All DVPRS components (pain intensity in last 24 hours, pain interference with activity, pain interference with sleep, pain affecting mood, pain affecting stress) showed a statistically significant decrease, with the largest improvement reported for quality of sleep (MD=1.44, p<.001, *d*=.778). No significant correlations were detected between baseline PAM-13 scores and reported change on all outcome measures and physical function assessment. Significant negative correlations were found between PAM-13 and TSK-17 at both baseline and upon completion of the program.

Conclusion: Significant improvements were found on all outcome measures and physical function assessments after a three-week IOP suggesting that individuals with persistent pain at any level of patient activation may benefit from an IOP. Future research should focus on assessing patient activation in individuals with persistent pain following the program to determine long-term changes and whether the changes are related to physical and psychosocial function.

Key words [patient activation, chronic pain, interdisciplinary pain management, intensive outpatient program, outcomes]

Introduction

One in five Americans suffer from persistent pain and the statistic is more astounding *in* the U.S. military, with at least 44 percent of active duty Soldiers reporting persistent pain after deployment and 15 percent regularly managing pain with opioid medication, resulting in decreased military readiness and fitness to fight (Toblin et al., 2014). Since 2009, the DoD and Veterans Health Administration made pain management a priority aiming to limit long-term opioid use and promote nonpharmacological, complementary and integrative health services which encompasses increased patient awareness, understanding and skill to self-manage (Hudson et al., 2017; Office of the Army Surgeon General Pain Management Task Force, 2010; Rosenberg et al., 2018).

Interdisciplinary intervention involves a grouping of treatments which may include individual and group therapy, medication management, psychosocial education, functional training, physical therapy or some form of graded exercise program, acupuncture and yoga (Gardea & Gatchel, 2000). It is considered one of the most effective management programs because it allows for a variety of ways to address the many complex dimensions of persistent pain (Gardea & Gatchel, 2000; Gatchel & Okifuji, 2006; Scascighini et al., 2008). The goal of interdisciplinary intervention is to promote positive changes and patient self-management strategies that are sustainable in the long-term. The biopsychosocial approach of interdisciplinary interventions addresses not only the physical components of pain but also the impact of psychological and social influences on the state and well-being of an individual (Bevers, Watts, Kishino, & Gatchel, 2016). For example, interdisciplinary care has been demonstrated to have effectiveness in decreasing pain, improving detrimental psychological states such as

catastrophizing or fear of movement, in addition to improving function, coping skills and ability to self-manage symptoms (Craner, Sperry, & Evans, 2016; Day et al., 2017; Gatchel et al., 2009; Jensen, Turner, & Romano, 2007; S. J. Kamper et al., 2015). Evidence supports that understanding one's own persistent pain and actively engaging in one's own health care, including the ability to self-manage, is associated with improved health status, health behaviors and decreased healthcare and medication utilization (Fowles et al., 2009; Greene & Hibbard, 2012; Harvey et al., 2012; D. D. McGeary et al., 2012).

Various measures have been described for assessing the outcomes of interdisciplinary interventions for persistent pain; however, there is no standardization or consensus across treatment programs regarding the optimal test battery. These measures include assessments of pain intensity and pain interference with activities; disorder-specific assessments; physical function assessed with survey or performance testing; and a variety of psychosocial assessments including fear of movement and reinjury, pain catastrophizing, self-efficacy, depression and quality of life questionnaires in an attempt to include the many aspects of persistent pain (Dennis C. Turk et al., 2016). Patient activation is a latent construct which describes an individual's understanding of the need to be an active manager of his or her own health and health care and confidence in the ability to do so (Hibbard & Mahoney, 2010). This construct has been assessed in a variety of chronic conditions but not specifically in individuals with persistent pain (Kinney et al., 2015).

The patient activation measure (PAM) was developed to quantify the level of knowledge, skill and confidence in managing one's own health and has been used in to

assess this construct in populations with various chronic conditions (Donald et al., 2011; Hibbard et al., 2004). Studies have found that those with higher patient activation levels are not only more independent with managing their health but also tend to be more satisfied with their health care because they know how to be advocates for their own health and therefore know how, and when, to access health care services (Donald et al., 2011; Kinney et al., 2015; Mosen et al., 2007). Individuals with lower patient activation were more likely to be hospitalized for their chronic condition, utilize emergency room services and have lower medication adherence in some conditions (Kinney et al., 2015; Mosen et al., 2007).

The PAM has been used to evaluate the effect of brief interventions including training individuals on effective ways to interact and ask questions of their primary care providers and teaching self-management skills for persistent pain; however, it has not been described for evaluating the effect of an interdisciplinary treatment for persistent pain on activation (Deen, Lu, Rothstein, Santana, & Gold, 2011; Nost et al., 2018). Because interdisciplinary treatment programs help participants understand and improve knowledge of their persistent pain, learn how to cope and move alongside their pain while effectively managing their symptoms the PAM would likely be a useful way to assess outcome following these programs (Gatchel et al., 2014; Hibbard et al., 2004). The primary objective of the present study was to examine the change in the Patient Activation Measure and assess its relationship with measures of fear of movement, pain interference, and physical function assessment in an intensive outpatient program (IOP) for military service members with persistent pain. The secondary objective was to

determine whether the changes in all outcome measures in this military specific intensive outpatient program were significant from baseline to graduation.

Methods

Study Design

This was a retrospective analysis of data obtained from individuals who participated in an IOP for persistent pain at a military pain management center from January 2017 through August 2018. This research was reviewed and approved by the Department of the Army Regional Health Command – Atlantic and the University of South Carolina Institutional Review Boards.

Intensive Outpatient Program

The IOP staff accepts 8 to 12 service members to participate in each of approximately 8 sessions per year. The interdisciplinary IOP for persistent pain is a full-time, 3-week treatment program with 85 hours of various group and individual therapies and education including: 10 hours in-classroom education on pain neuroscience, sleep, medication management and goal setting; 10 hours of group behavioral therapy; 12 hours each of meditation and yoga; 6 to 8 hours of individual complementary therapy such as acupuncture, massage, and chiropractic treatments; and over 45 hours of physical conditioning and exercise including physical readiness training, aquatic therapy, adventure therapy, group rehabilitation and circuit training, advanced exercise, and Soldier skills. On the first and last day of the program, evaluation and assessment are completed including a physical examination, various patient reported outcomes and a physical function assessment. The interdisciplinary team includes a pain physician,

physiatrist, neurologist, pharmacist, acupuncturist, chiropractor, behavioral health specialist, nurse case manager, yoga instructor, massage therapist, occupational therapist, and physical therapist.

Data Collection

The demographics collected included age, sex, military occupational specialty (MOS), military rank, branch of service, time in service, number and length of deployments, persistent pain duration, tobacco use, and whether participants were already receiving some type of behavioral health services at the start of the program.

Primary outcome measure

The Patient Activation Measure was designed to assess patient skill, knowledge, and confidence for self-management fit for various medical conditions (Hibbard et al., 2004). The PAM short-form, used in the IOP, is the reduced version of PAM, from 22 to 13 items and has comparable Rasch reliability (0.87, 0.81 respectively) (Hibbard et al., 2005). The measure is scored on a 0-100 scale with higher scores indicating higher patient activation (Hibbard et al., 2005). The scale differentiates four levels of activation which include: (1) belief that active role is important; (2) confidence and knowledge to take action; (3) taking action; and (4) staying the course under stress (Hibbard et al., 2007; Hibbard et al., 2005).

Secondary outcome measures

The Defense and Veterans Pain Rating Scale (DVPRS) was developed in 2010 as a result of a recommendation which came out of the Army Pain Management Task Force

assessing pain management across the entire Department of Defense (DoD) (Buckenmaier et al., 2013). The DVPRS is a numerical pain assessment tool from 0 to 10 with descriptors, facial expressions and color-coding corresponding to the numbers. Additional four questions about pain interference with sleep, activity, mood, and contributing to stress are reported on the same scale from 0 (does not interfere) to 10 (completely interferes) (Buckenmaier et al., 2013). Measures from this scale were shown to have evidence of internal consistency (Cronbach's alpha = 0.871) and had high test-retest reliability (0.637 - 0.774) (Polomano et al., 2016).

The Tampa Scale of Kinesiophobia-17 (TSK-17) was developed to assess fear of movement and re-injury in populations with persistent pain (Miller RP, 1991). The score ranges from 17 to 68 with lower scores indicating no or minimal fear and higher scores indicating greater fear of movement, re-injury and avoidance behavior (Miller RP, 1991; Vlaeyen JW, 1995). Initially, validated in Dutch, measures from the English version of the TSK-17 have evidence of internal consistency in populations with persistent pain (Cronbach's alpha = 0.84). (French et al., 2007; Goubert et al., 2004). The cut-off score for the TSK-17 is 37, with scores higher than 37 indicating high fear of movement and low response in a treatment program and scores lower than 37 indicating lower fear of movement and high response to treatment (French et al., 2007; Vlaeyen JW, 1995).

The physical function assessment was specifically created for the purpose of this IOP and was based on Army standards. High physical capacity is a key aspect of being in the military. Meeting the standard on an annual Physical Fitness Test (PFT) is the minimum requirement for all service members in addition to other physical demands based on occupational requirements (U.S. Army, 2012). Various additional physical

assessments exist based on military occupation with most recent adoption of the Occupational Physical Assessment Test (OPAT) currently administered to all Army recruits (U.S. Army, n.d.). The IOP interdisciplinary team combined portions of various military physical assessments and other functional movements to create a physical function assessment for the IOP. In our analysis, we used three of the events on the assessment which are currently used in at least one of the military fitness tests. The deadlift and interval aerobic run measuring lower extremity strength and aerobic capacity respectively, were taken directly from Occupational Physical Assessment Test (U.S. Army, n.d.). In order to pass the deadlift and run portions of the OPAT with a "gold" rating or lowest passing, Soldiers must perform a 120-pound deadlift and run one mile over the course of 36 shuttles within 10:27 minutes (U.S. Army, n.d.). The push-up measures muscle endurance, upper body and core strength reflecting one component of the Army Physical Fitness Test (U.S. Army, 2012). The number of push-ups required to pass the test varies based on sex and age; for example, a male service member, 17-21 years old, is required to perform a minimum of 42 push-ups, while a female in the same age range needs a minimum of 19 pushups in order to receive 60 points, the lowest passing score, for this event on the fitness test (U.S. Army, 2012).

Data Analysis

Demographic characteristics were summarized using descriptive statistics and were stratified by gender. Means, standard deviations, 95% confidence intervals (CI), and effect sizes were calculated for all outcome measures and physical function assessment. Paired t-test were performed to determine pre- to post-intervention changes. Correlations were performed to examine associations between PAM-13, TSK-17, DVPRS, and the

physical function assessment components. Spearman rank correlation was used to assess the strength of associations and relationships for the data because normality of data could not be assumed and variables were measured on a scale (Debbie L. Hahs-Vaughn, 2013). P-values and r-coefficients were reported ($p \leq 0.05$).

Results

A total of 105 participants (70.5% male) were included in the study. This included all patient participants in the treatment program during the sampling period. The majority of the participants were at the rank of enlisted (95.2%), working in communication and information systems or military intelligence (56.2%), deployed overseas at least once (51.4%), did not use tobacco products (81.9%), and were not receiving any behavioral health treatment at onset of IOP (86.7%). The average age of participants was 29.02 ± 6.90, with time in service of 102.63 ± 77.52 months, and pain duration of 56.68 ± 53.24 months (Table 1).

Pre- to post-treatment changes

All outcome measures showed statistically significant change from pre to post-treatment for the entire sample. The average patient activation increased from level 3 (59.51 ± 14.13) to level 4 (69.67 ± 16.50) with a moderate effect size (d=.738) (Table 2). When broken out by level of activation at start of the intervention, those starting at level 1 (41.39 ± 4.80) graduated from the program at level 2 (54.70 ± 9.61) of patient activation. Participants starting at level 2 (50.22 ± 2.34) and 3 (60.83 ± 3.47), were at level 3 (62.25 ± 15.55) and 4 (72.64 ± 13.39), respectively, at the end of the program. Participants starting the program at level 4 (77.62 ± 9.73) could not increase to the next

level but still showed an increase in activation score within level 4 (81.79 ± 14.52), although the change was not statistically significant (Table 3). When data was split by gender, PAM-13 score for males (n=74) increased from 60.16 ± 15.21 points (level 3) to 68.33 ± 15.65 points (level 4, p<.001). Female participants (n=31) started IOP at 58.00 ± 11.29 points (level 3) and increased to an average of 72.81 ± 18.23 points (level 4, p<.001). Both changes were statistically significant with a moderate effect size for males (*d*=.615) and a large effect size for females (*d*=1.07) (Tables 4&5).

The TSK-17 mean score for the entire sample decreased by 4.44 ± 6.39 points to 35.63 ± 7.09 (p<.001, *d*=.695). All DVPRS components showed a statistically significant decrease in pain interference for the overall sample with the largest improvement reported for sleep quality (Mean diff=1.44 ± 1.85, p<.001, *d*=.778) (Tables 2, 4-5).

The physical function analysis was also split by gender to better reflect the changes that occurred. Male participants increased the number of push-ups performed from 37.57 ± 13.21 to 41.84 ± 13.41 (p<.001), while on the deadlift they increased from level 8 (200lbs) to level 9 (210lbs) (p<.001). On the shuttle run, male participants improved from 29.07 ± 11.49 shuttles to 35.30 ± 16.19 shuttles (p<.001). Female participants improved in two events with push-ups increasing from 20.43 ± 13.43 to 24.57 ± 13.38 (p=.002), and deadlift from level 3 (120lbs) to level 5 (160lbs) (p<.001). However, the increase in shuttle runs from 17.93 ± 6.72 to 20.70 ± 10.95 was not significant for females (p=.126) (Tables 4&5).

Associations

Baseline PAM-13 was negatively correlated with baseline TSK-17 total score (r= -.311, p=.001) and its Fear (r=-.305, p=.002) and Harm (r=-.205, p=.036) subscales. All other baseline scores on outcome measures were not significantly correlated with baseline PAM-13 scores (Table 6). No significant correlations between baseline PAM-13 scores and reported change on all of the outcome measures and physical function assessment were detected (Table 7). Higher PAM-13 scores upon completion of the program were significantly associated with lower scores on the TSK-17 (r=-.479, p<.001), its Fear and Harm subscales (r=-.435, p<.001 and -.456, p<.001 respectively) and the DVPRS mood (r=-.353, p<.001), stress (r=-.309, p=.001), and activity (r=-.215, p=.028) questions at the end of the program (Table 8).

Discussion

The primary objective of this study was to assess the change in the PAM-13 and its relationship with outcome measures in an intensive treatment program for persistent pain. Regardless of patient activation level at baseline, all participants showed improvement in the program moving to the next higher level except those who started the program at level 4 and could not move up to the next level. Individuals starting at level 4 did show a small increase in the activation score within the level although the change was not statistically significant. Participants starting at level 4 already came to the program with high degree of skill, knowledge and confidence in self-management therefore their activation may not have significantly changed but nonetheless they still likely benefitted from the program by learning additional tools and fine-tuning skills they already had as

seen in a previous study (Harvey et al., 2012). The degree of change was also limited by a ceiling effect since those participants already started at the highest level of activation. Our study suggests that individuals with persistent pain at all levels of activation at baseline may benefit from an intensive outpatient program.

At baseline, patient activation was inversely related with the fear of movement and reinjury experienced by participants. This relationship was also present upon completion of the program with the addition of an inverse relationship between PAM-13 and activity, mood, and stress components of the DVPRS. All correlations were small to moderate. Participants who started the program at a higher PAM-13 score, had a lower fear of movement and reinjury as measured by the TSK-17. Similarly, those who completed the program at a higher PAM-13 score, had lower pain interference with activity, mood and stress, in addition to lower TSK-17 scores. This relationship makes sense because by developing skill, knowledge and confidence to self-manage a condition, in this case persistent pain, individuals are more likely to have decreased fear of movement and pain interference due to a better understanding of their condition and what they are able to do. No significant relationship was noted between baseline PAM-13 and the change scores on the outcome measures which may have been due to the small sample size and lack of power.

While simply using PAM-13 as an additional outcome measure for the program may not provide additional information, the change in the measure's score supports the effectiveness of the program in improving patient activation and it could be a useful tool in assessing long-term patient activation, whether it fluctuates and how it affects outcomes down the road. Previous research in other chronic diseases has shown that

PAM-13 scores can reflect improved outcomes in the long-term, but patient activation can also fluctuate based on changes in condition or one's environment; therefore, when IOP participants returned to their regular work schedules and daily routines, their patient activation and use of skills they acquired may have also changed affecting long-term outcomes (Chubak et al., 2012; Hibbard, Greene, Shi, Mittler, & Scanlon, 2015). Upon return to work, participants were also not likely to continue the exceptionally high level of physical activity practiced during the program, therefore future research should reassess patient activation periodically after completion of the program and its association with health behaviors and outcomes.

The secondary objective of the study was to assess changes in all outcome measures in the military population attending the program. The fear of movement and reinjury decreased significantly with an average score below the 37-point cut-off which indicated low level of fear at the end of the intervention (Vlaeyen JW, 1995). This is consistent with previous studies showing that intervention programs for persistent pain that have a biopsychosocial treatment base result in decreasing fear of movement and disability (Monticone et al., 2016, 2017; Monticone et al., 2014).

All DVPRS components showed a statistically significant decrease from beginning to end of the program with low to moderate effect sizes for pain level and pain interference with activity, sleep, mood, and contributing to stress. All changes on the DVPRS were less than 2 points on the 10-point scale, which may not be clinically significant. There is no data on minimum clinically detectable change (MCID) for DVPRS documented, but if we were to apply the MCID from the Numerical Pain Rating Scale, at least a 2-point change is needed to be considered a clinically significant change

(Childs, Piva, & Fritz, 2005). Previous research has also shown that a unidimensional pain rating is not an adequate measure in persistent pain therefore, this study may further support the idea that assessing pain level on a numerical scale may not be of great value in individuals with persistent pain (Robinson-Papp et al., 2015). In addition, a three-week period may be too short to assess pain interference with activity, sleep and other psychosocial aspects and would be more meaningful assessed after completion of the program and return to home and work environment full-time.

The physical function assessment was an imperative component in this program. All interdisciplinary outpatient programs for persistent pain have some physical performance and exercise component, but military programs like the one in this study tend to be much more intensive because service members need to return to a high level of function and pass their respective physical fitness tests in order to stay in service, and this program often is the last attempt for improvement prior to a medical discharge. This particular IOP included over 40 hours of high-level physical training and exercise which allowed participants to test their limits and realize what they are or are not capable of doing and whether the progress they make in the program will jump start continued improvement in hopes of returning to full duty. In our study, male participants improved significantly on all three physical performance events assessed. The average number of push-ups after the program was 41, while 42 push-ups is the minimum number required to pass the Army Physical Fitness Test for the youngest male age group (U.S. Army, 2012). The majority of the participants were older, which placed them in age groups requiring fewer push-ups and therefore they would have likely passed this portion of their physical fitness test. Male participants also increased in the amount of weight they were

able to deadlift, however, the average for males was already fairly high at beginning of the program, with an average of 200lbs, indicating a passing score on the OPAT. Lastly, males also significantly improved on the shuttle run. While the latter two events are currently only part of the physical fitness test during basic training, the Army is currently piloting a new combat fitness test which will include a shuttle run and deadlift, making the events applicable even though the participants were not recruits. Similarly, female participants significantly improved on their push-up and deadlift events with both average scores resulting in a passing grade on the Army's current fitness test and OPAT, respectively. In addition, female participants averaged over 160lbs deadlift at the end of the three-week program, greater than the minimum preliminary requirement for the new Army Combat Fitness Test which, if unchanged after pilot testing, will require 140lbs deadlift on the gender-neutral test (U.S. Army TRADOC, 2018). The shuttle run was the only event which did not significantly improve among female participants. This may have been due to lower fitness levels at the start of the program because the initial shuttle run scores were much lower than their male counterparts. This intensive outpatient program resulted in significant changes not only in the psychosocial components of pain but also demonstrated significant functional performance improvements in a short three-week timeframe. These findings are consistent with previous studies which showed improved function, decreased pain and pain interference in military population with persistent pain (Gatchel et al., 2009; Pujol et al., 2015).

There were a number of limitations in this study. This was a retrospective data analysis therefore we cannot determine causal inferences. The participants analyzed were those who completed the program with no comparison to participants who may have been

dropped or quit the program for various reasons. The sample was small and outcomes measures were limited to ones used by the intensive pain program. Re-evaluating the outcome measures used and focusing on multidimensional scales may prove more beneficial in assessing outcomes of the program. Data analysis compared only baseline and immediate post-program results but we did not analyze long-term follow-up data which should be further explored. Lastly, this study included only military service members which is a specific population and results may not be applicable to other programs or populations.

Conclusion

Participants in this program showed improvement in patient activation, physical performance and reported decreased fear of movement and pain interference with activity, sleep, mood and contributing to stress suggesting that individuals with persistent pain at any level of patient activation may benefit from an interdisciplinary intensive outpatient program. Future research should focus on assessing patient activation following the program to determine long-term effects and whether activation is sustained and related to outcomes as participants return to their work environments full-time.

Table 4.3. Demographic characteristics of the sample by gender (n=105)

		Male	**Female**	**Total**
	Range	Mean (SD) or %	Mean (SD) or %	Mean (SD) or %
Age	19-52	29.73 (6.77)	27.32 (7.04)	29.02 (6.90)
Time in service	19-293	111.32 (79.27)	81.87 (70.07)	102.63 (77.52)
Time deployed (months)	0-74	13.15 (15.54)	3.55 (7.03)	10.31 (14.26)
Pain duration (months)	5-264	61.73 (57.03)	43.97 (40.32)	56.68 (53.24)
Rank				
E1-E4[a]		44.6	67.7	51.4
E5-E9[b]		51.4	25.8	43.8
Officers		4.0	6.5	4.8
MOS**				
25[c]		20.3	29.0	22.9
35[d]		35.1	29.0	33.3
Other		55.4	42.0	43.8
Number of deployments				
0		37.8	74.2	48.6
1		25.7	16.1	22.9
2		17.6	6.5	14.3
3 or more		18.9	3.2	14.2
Tobacco Use		18.9	16.1	18.1
Behavioral Health		12.2	16.1	13.3
Past surgeries		55.4	61.3	57.1
N		74	31	105

Notes: a-lower enlisted, b-noncommissioned officers; **Military Occupational Specialty; c-Communications & information system specialist, d-military intelligence

Table 4.4. Paired t-tests for overall sample (n=105)

Measure	**Descriptive Statistics**			**Paired T-test Statistics**							
	Mean	Std Dev	Std.Err	Mean Diff	Std. Dev.	Cohen's *d*	Lower	Upper	*t*	*df*	*p*
PAM-13				-10.15	13.75	.738	-12.83	-7.48	-7.53	103	.000
Pre	59.51	14.13	1.39								
Post	69.67	16.50	1.62								
DVPRS Pain				.706	1.77	.399	.359	1.05	4.04	101	.000
Pre	4.98	1.43	.141								
Post	4.27	2.03	.201								
DVPRS Activity				.452	2.10	.215	.044	.860	2.20	103	.030
Pre	4.38	1.97	.193								
Post	3.92	2.25	.221								
DVPRS Sleep				1.44	1.85	.778	1.08	1.80	7.94	103	.000
Pre	4.42	2.55	.250								
Post	2.98	2.47	.242								
DVPRS Mood				1.11	2.16	.514	.686	1.53	5.23	103	.000
Pre	4.14	2.24	.219								
Post	3.04	2.52	.247								
DVPRS Stress				1.14	2.48	.460	.653	1.62	4.67	103	.000
Pre	4.37	2.60	.255								
Post	3.23	2.52	.247								
TSK Total				4.44	6.39	.695	3.20	5.69	7.09	103	.000
Pre	40.08	7.26	.712								
Post	35.63	7.09	.695								

Table 4.5. PAM-13 Level change during the 3-week IOP for overall sample (n=105)

Baseline level	**Baseline score M(SD)**	**End level**	**End score M(SD)**	**Cohen's *d***	***t***	***df***	***p***
Level 1	41.39 (4.80)	Level 2	54.70 (9.61)	1.75	-5.63	19	.000
Level 2	50.22 (2.34)	Level 3	62.25 (15.55)	1.08	-3.33	18	.004
Level 3	60.83 (3.47)	Level 4	72.64 (13.39)	1.21	-5.59	37	.000
Level 4	77.62 (9.73)	Level 4	81.79 (14.52)	.34	-1.52	26	.140

Table 4.6. Paired t-tests for male participants (n=74)

Measure	**Descriptive Statistics**			**Paired T-test Statistics**							
	Mean	Std Dev	Std Err	Mean Diff	Std. Dev	Cohen's *d*	Lower	Upper	*t*	*df*	*p*
PAM-13				-8.18	13.31	.615	-11.28	-5.07	-5.25	72	.000
Pre	60.16	15.21	1.78								
Post	68.33	15.65	1.83								
Push-ups				-4.27	9.20	.464	-6.40	-2.14	-3.99	73	.000
Pre	37.57	13.21	1.54								
Post	41.84	13.41	1.56								
Deadlift				-1.14	2.02	.564	-1.60	-.667	-4.83	73	.000
Pre	8.28	2.36	.274								
Post	9.42	1.35	.156								
Shuttle run				-6.23	13.66	.456	-9.46	-2.99	-3.84	70	.000
Pre	29.07	11.49	1.36								
Post	35.30	16.19	1.92								

Table 4.7. Paired t-tests for female participants (n=31)

Measure	**Descriptive Statistics**			**Paired T-test Statistics**							
	Mean	Std Dev	Std Error	Mean Diff	Std. Dev.	Cohen's *d*	Lower	Upper	*t*	*df*	*p*
PAM-13				-14.81	13.86	1.07	-19.90	-9.73	-5.95	30	.000
Pre	58.00	11.29	2.03								
Post	72.81	18.23	3.27								
Push-ups				-4.13	6.71	.615	-6.64	-1.63	-3.37	29	.002
Pre	20.43	13.43	2.45								
Post	24.57	13.38	2.44								
Deadlift				-1.50	1.28	1.17	-1.98	-1.02	-6.42	29	.000
Pre	3.97	1.90	.347								
Post	5.47	2.22	.406								
Shuttle run				-2.77	9.61	.288	-6.36	.821	-1.58	29	.126
Pre	17.93	6.72	1.23								
Post	20.70	10.95	2.00								

Table 4.8. Correlation between PAM-13 **pre-**intervention score and outcome measures **pre**-intervention (n=105)

Spearmans rho	r	p
DVPRS pain	-.122	.220
DVPRS Activity	-.089	.366
DVPRS Sleep	-.094	.343
DVPRS Mood	-.125	.203
DVPRS Stress	-.085	.390
TSK total	-.311**	.001
TSK Fear	-.305**	.002
TSK Harm	-.205*	.036
Push-up	.086	.387
Deadlift	.157	.112
Shuttle run	-.004	.967

Table 4.9. Correlation between PAM-13 **pre**-intervention score and reported **change** in outcome measures (n=105)

Spearmans rho	r	p
DVPRS pain	.033	.742
DVPRS Activity	.059	.555
DVPRS Sleep	-.107	.281
DVPRS Mood	.112	.257
DVPRS Stress	.101	.305
TSK total	.053	.596
TSK Fear	.033	.738
TSK Harm	.121	.222
Push-up	.138	.164
Deadlift	-.133	.177
Shuttle run	.022	.829

Table 4.10. Correlation between PAM-13 **post**-intervention score and outcome measures **post**-intervention (n=105)

Spearmans rho	r	p
DVPRS pain	-.155	.116
DVPRS Activity	-.215*	.028
DVPRS Sleep	-.053	.594
DVPRS Mood	-.353**	.000
DVPRS Stress	-.309**	.001
TSK total	-.479**	.000
TSK Fear	-.435**	.000
TSK Harm	-.456**	.000
Push-up	-.052	.605
Deadlift	-.089	.370
Shuttle run	-.161	.109

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4.3 Manuscript 3

Feasibility and acceptability of ecological momentary assessment of U.S. military service members' persistent pain and psychosocial well-being during an intensive outpatient pain program.[3]

[3]Bujak, B.K., Monroe, C., Blake, C.E., Beattie, P.B., Harrington, S. To be submitted to *Clinical Journal of Pain.*

Abstract

Background: One in 5 Americans suffers from persistent pain and the number is even higher among U.S. military service members. An intensive outpatient program is one variation of interdisciplinary management targeting cognitive-behavioral aspects of pain such as coping, stress management, mindfulness and social support in addition to intensive, daily functional rehabilitation. One of the methods to improve understanding of pain is ecological momentary assessment (EMA) which has not been utilized in active duty military population to study persistent pain or monitor participation in an interdisciplinary intensive outpatient program.

Objective: The study tested the feasibility of using a mobile app to monitor daily self-reported pain, psychosocial indicators and attitudes in an intensive outpatient program for persistent pain.

Methods: Twenty-two military service members in an intensive outpatient pain program were recruited (age 21-51, 59.1% male). Commercially-available PACO© app was used in the study. Participants downloaded the app to their smartphones and answered 12 questions at the end of each day of the 3-week program including weekends (19 days). Up to two reminders were triggered if the survey was not completed after the first prompt. Descriptive statistics were calculated for compliance rates and all other variables. Means and standard deviations were calculated for continuous variables, frequencies and percentages were calculated for categorial variables. Pain trajectories and stress levels for all participants were graphed to assess any trends by day.

Results: Eleven of the 22 participants completed 100% of the daily surveys. Overall compliance was 91.1%. Participants reported receiving social support 77.5% of the days reported and considered it beneficial 91.4% of the time. The most frequent types of social support received were esteem support (69.4%), informational support (56.5%), and emotional support (53.7%). Participants reported making progress toward their individual goals 73.0% of the days reported. Pain and stress level trajectories showed high variability in between and within-participants throughout the 3 weeks. Majority of passive and active components of the program were considered beneficial regardless of whether they increased or decreased pain.

Conclusion: EMA using a smartphone application for monitoring various outcome measures during an intensive outpatient program for persistent pain was feasible among military service members and may be a beneficial tool for additional monitoring of participant progress in the program and beyond.

Keywords: chronic pain, ecological momentary assessment, intensive outpatient program, patient monitoring

Introduction

Twenty percent of U.S. adults are afflicted with some form of persistent pain (Dahlhamer et al., 2018). In 2011, the Institute of Medicine Report: *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research,* revealed that persistent pain costs in the United States, including healthcare and lost productivity, are between $560-$636 billion annually (Institute of Medicine Committee on Advancing Pain Research & Education, 2011). In the U.S. military, the statistics are even more staggering with at least 44 percent of active duty Soldiers reporting persistent pain after deployment and 15 percent regularly managing pain with opioid medication, resulting in decreased military readiness and fitness to fight (Toblin et al., 2014). Since 2009, the Department of Defense (DoD) and Veterans Health Administration (VHA) has made pain management a priority, aiming to promote nonpharmacological, complementary and integrative health services for persistent pain and limit long-term opioid use. This increased emphasis on addressing pain management is expected to remain a top priority, particularly considering the current opioid crisis and the failure of opioids to represent an effective, long-term solution for persistent pain. (Hudson et al., 2017; Office of the Army Surgeon General Pain Management Task Force, 2010; Rosenberg et al., 2018).

Interdisciplinary Pain Management Centers were created within the DoD and VHA to improve treatment of persistent pain using a biopsychosocial approach characterized not only by medication and interventional pain management but also by cognitive-behavioral therapy, functional rehabilitation and complementary therapies such as acupuncture, yoga and massage (Anamkath et al., 2018; Schoneboom et al., 2016). An

intensive outpatient program, enrolling 8-12 patients per session for a total of 110-120 patients per year, is one component of interdisciplinary management designed to target cognitive-behavioral aspects of pain such as coping, stress management, mindfulness and social support in conjunction with intensive, daily functional rehabilitation (Gatchel et al., 2009; Interdisciplinary Pain Management Center, n.d.). Substantial evidence has linked stress and social support with persistent pain outcomes, increasing the importance of addressing these aspects (Generaal et al., 2016; Lopez-Martinez, Esteve-Zarazaga, & Ramirez-Maestre, 2008; Osteras, Sigmundsson, & Haga, 2015). Despite a decade of well-intentioned interdisciplinary efforts focused on pain management, including the implementation of this intensive outpatient program, effective persistent pain management presents an ongoing challenge. Thus, there is a clear need to better understand individual pain experience to help inform the optimization of pain management programs not only by focusing on pain trajectories, but also by assessing key psychosocial indicators linked to pain that are inherently targeted by the program.

Various methods have been used to gain a better understanding of persistent pain among the general population, including ecological momentary assessment (EMA) (May et al., 2018) EMA is not one single research method and involves gathering intensive, longitudinal data, sampling experiences or behaviors in real-time and natural environment (Shiffman et al., 2008). For example, EMA allows for the reporting of various aspects of pain and related factors and experiences in a natural environment, minimizing the effect of retrospective recollection that can be influenced by peak pains or biased by the emotional state someone is in right before or during recollection (Gendreau, Hufford, & Stone, 2003; Van den Bergh & Walentynowicz, 2016). A number of

techniques are used for EMA and may include paper diaries, electronic diaries, internet-based electronic surveys and most recently, smartphone applications where the technologically advanced methods may help increase compliance by setting reminders which can prompt participants to respond at a given time (Garcia-Palacios et al., 2014; Shiffman et al., 2008). Smartphones represent an attractive and convenient way to implement EMA-based survey prompts without creating a significant burden for the respondent given their dynamic features and reach (i.e., 77% of U.S. adults own a smartphone) (Pew Research Center, 2018; Runyan & Steinke, 2015). There are an increasing number of commercially-available apps that can be utilized for research or clinical use. Compared to traditional measures, the use of smartphone apps to monitor persistent pain has shown construct validity, high compliance, acceptability and ease of use (W. C. Lin, Burke, Schlenk, & Yeh, 2018; Suso-Ribera et al., 2018). To our knowledge, no pain management studies have utilized EMA, let alone via smartphones, to gain insights into the experiences and perspectives of active duty military members, including those engaging in an intensive outpatient program. Therefore, the purpose of this study was to assess the feasibility and acceptability of using a smartphone-based EMA approach to monitor the pain trajectories, psychosocial indicators, and attitudes of U.S. military service members participating in an intensive outpatient program.

Methods

Study design

Daily ecological momentary assessment data concerning active duty U.S. military service members' pain management experiences were collected during a 3-week (19

days) persistent pain intervention as part of a larger study focused on gaining insight into the process of change in the understanding of persistent pain through consideration of past and present experiences, psychosocial factors, personal and work relationships and stressors, attitudes, goals and future expectations.

Participant recruitment and eligibility

Participants were recruited from the Intensive Outpatient Program (IOP) at Dwight D. Eisenhower Army Medical Center, GA between September and December 2018. All participants were military service members, suffering from persistent pain who were determined eligible for the program by an interdisciplinary team of providers. All participants were referred to the program by their primary care physician or a specialty clinic and had various treatments in the past, which included but were not limited to physical therapy, medications and interventional pain management that did not sufficiently manage their symptoms. To be eligible for the study, participants had to own a smartphone (iPhone or Android). Participants were recruited on the first day of three consecutive cycles of IOP. The research staff presented an overview of the study, its purpose and expectations from participants. Interested participants provided contact information for enrollment. No incentives were provided to the participants for the study.

Intensive Outpatient Program

The interdisciplinary IOP for persistent pain is a full-time, 3-week treatment program, totaling approximately 85 hours of various group and individual therapies and education. Each of the program cycles enrolls 8 to 12 participants. The program schedule consists of 10 hours in classroom education on various topics such as pain neuroscience

education, sleep, medication management and goal setting; 10 hours of group behavioral therapy; 12 hours each of meditation and yoga; 6 to 8 hours of individual complementary therapy such as acupuncture, massage, and chiropractic treatments; and over 45 hours of physical conditioning and exercise including physical readiness training, aquatic therapy, adventure therapy, group rehabilitation and circuit training, advanced exercise, and Soldier skills. On the first and last day of the program, evaluation and assessment are completed including a physical examination, various patient reported outcomes and a physical function assessment. The interdisciplinary team includes a physiatrist, neurologist, pharmacist, acupuncturist, chiropractor, behavioral health specialist, nurse case manager, yoga instructor, massage therapist, occupational therapist, and physical therapist.

Procedures

Participants gave written informed consent and signed HIPAA forms. Participants then provided demographic information on a hand-written survey including age, sex, marital status, branch of service, military rank, time in service, number of deployments, and pain duration. Participants were also guided through the installation of the smartphone application used to collect the ecological momentary assessment data. Once installed, participants were shown how to log-in to the application using their study email address and sign up to receive the daily survey prompts. The application was set to prompt participants at 4pm daily to answer the survey. Participants who did not complete the survey upon the initial prompt received up to two additional prompts to complete it each day (at 6pm and 9pm). Once the daily survey was completed by the participant, he or she did not receive any more reminders that day. Due to the intensity of the IOP

schedule, an end-of-day assessment was used to prevent disruption during program activities. The use of end-of-day assessment of pain has been shown to be reliable and valid when compared to random daily assessments (Broderick et al., 2009; Carlozzi et al., 2018; Perrot et al., 2011). As part of oversight for the larger study, research staff were present on most days of the IOP and gave additional verbal reminders to the participants to complete the surveys.

Ecological Momentary Assessment

The Personal Analytics Companion or PACO© application (Paco Developers, v 1.1.8), was used for data collection. The application is an open-source platform designed to be used for behavioral research and is compatible with both Android and iOS smartphones. Each participant was assigned with a study name (e.g., [study name]) and study email address (e.g., study_email@gmail.com) that was not associated with their name or personal email address to use as a login for the app. The research staff tracked the type of operating system used and any technical issues encountered by the participants.

Each day, the participants answered the same 12 questions. The survey asked one question each about pain severity (0-10 scale) and perceived stress (0-10 scale). Participants reported whether they had to take any pain medication beyond their regular prescriptions (yes or no), and whether they made progress toward their goal (yes or no). Four questions asked to select all program components which were attended, increased pain, decreased pain and were considered beneficial each day. Three questions were asked about perceived presence of social support for pain management (yes or no), the

type(s) of social support received (informational, esteem, tangible, emotional, network, or no support), and whether it was perceived to be beneficial throughout the program (yes or no) (Schaefer et al., 1981). Upon completion of the IOP, participants were asked to rate their satisfaction with the program, easiness of integrating the use of the smartphone app in the evenings and willingness to answer daily surveys in the future on a 5-point Likert scale (strongly agree-strongly disagree) using text messaging. All materials and procedures were approved by the Department of the Army Regional Health Command – Atlantic and the University of South Carolina Institutional Review Boards. (See Appendix F for the entire survey.)

Data analysis

All data were downloaded from the PACO© app website in a Microsoft Excel file and then uploaded into and analyzed using IBM® SPSS® v.24.0 (Amonk, NY:IBM Corp). Descriptive statistics were calculated to provide summaries for compliance rates and all other variables during the three-week IOP. Means and standard deviations were calculated for continuous variables, frequencies and percentages were calculated for categorial variables. Additionally, pain and stress level trajectories were graphed over time for each individual participant using Microsoft Excel (2019). Attitudes regarding individual components of the program were calculated including which were considered beneficial and increased or decreased pain.

Results

Twenty-five potential participants were attending IOP during our data collection timeframe. Of those, 24 individuals consented to participate in our study and one

declined. Two of the 24 consenting participants withdrew from IOP on the first day and did not initiate the study. A total of 22 program participants completed daily questionnaires on the smartphone app. The majority of the respondents were male (59.1%), married (81.8%), enlisted (90.9%), in the Army (63.6%), and had not deployed overseas (59.1%). Participants' average age was 28.2 (7.4) with an average time in service of 8.3 (6.8) years. Pain duration ranged from less than a year to eight years (Table 1).

Thirteen participants used an Android-based smartphone while nine used an iOS-based smartphone. There were no significant technical difficulties during the three-week data collection period. One participant received an error message while attempting to submit her daily survey despite several attempts, however, this only happened once. No other participants reported missing survey completion due to technical issues.

Compliance

Eleven of the 22 participants completed 100% of the daily surveys. Overall compliance was 91.1% (381 out of 418 days), with 308 of 330 (93.3%) weekday and 73 of 88 (83.0%) weekend surveys completed. The compliance for week one (weekdays) was 96.4% (106 out of 110), week two was 94.5% (104 out of 110), and week three was 89.1% (98 out of 110). The two weekends included in the three-week data collection period had similar rates of completion with a slight decrease from the weekend after week one (92.0%; 81 out of 88) to the weekend after week two (90.9%; 80 out of 88).

Social Support

Participants reported receiving social support for the pain management 324 out of 418 days (77.5%) with more frequent reports of received support during weekdays (85.7%; 283 out of 330 days) compared to weekends (46.6%; 41 out of 88 days). The most frequently reported types of social support received were esteem support (69.4%; 225 out of 324 days), informational support (56.5%; 183 out of 324 days), and emotional support (53.7%; 174 out of 324 days). Of the days participants reported receiving social support, they responded that it was beneficial 91.4% (296 out of 324 days) of the time (Figure 1&2).

Goal Progress and Medication Use

Participants reported making progress toward their personal IOP goals 305 of the 418 (73.0%) days surveyed (Figure 3). Use of pain medications in addition to their individual pain management regimen prescribed prior to or at the beginning of the program, was reported on 61 of the 418 (14.6%) days surveyed. Common additional medications included naproxen, aspirin, meloxicam or Biofreeze gel (Figure 4).

Pain Intensity and Stress

Pain and stress level trajectories showed high variability between and within participants throughout the three weeks. Neither trajectory demonstrated an upward or downward trend through the course of the program (Figures 5&6).

Attitudes toward individual intervention components

For intervention treatments that were reported as attended by participants, massage was most frequently indicated to be beneficial (76%; 35 out of 46 days) and cause a decrease in pain (89%; 41 out of 46 days) relative to other intervention components. Similarly, the intervention elements reported to be beneficial more than 50% of the days in which participants engaged in them were as follows: yoga (67%; 68 out of 101 days), chiropractor (62%; 62 out of 100 days), acupuncture (60%; 24 out of 40 days), aquatics (59%; 58 out of 98 days), circuit training (53%; 54 out of 101 days) and advanced exercise (51%; 45 out of 88 days). Interventions which resulted in subsequent reports of an increase in pain on more than 50% of the days in which the participants engaged them were as follows: circuit training (57%; 58 out of 101 days), morning physical training (64%; 95 out of 148 days), and Soldier skills (66%; 51 out of 77 days). All three of these intervention elements were still considered beneficial at least one third of the time despite the high reported frequency of increased pain (Table 2).

Acceptability

Fourteen of the 22 participants responded to the acceptability questions (63.6%). All of the respondents reported that they were satisfied with the 3-week IOP, found answering the daily survey questions on a smartphone to be an easy task to integrate into their day, and would be willing to answer the daily survey questions again.

Discussion

This study was the first to use EMA to monitor active duty U.S. military members' self-reported progress, perspectives and experiences while participating in an

interdisciplinary, intensive outpatient program for persistent pain. The use of a commercially available smartphone app proved to be feasible and acceptable among the participants. The high compliance rates for survey completion that were observed from week-to-week were high and especially notable given no incentives were offered in our study. No frequent technical issues were encountered. All participants reported that the PACO app was easy to use, and they would be willing to answer survey questions again via this method.

All participants downloaded the app, were individually trained and had close oversight with a researcher present on most days of the program. Using a device that participants already owned instead of issuing another device for the study decreased the burden on the participants and may have contributed to compliance (Burke et al., 2017). Our compliance rate was higher compared to a recent meta-analysis which reported an EMA completion compliance rate of 85% in persistent pain research (Ono, Schneider, Junghaenel, & Stone, 2019). Participants received up to 2 text message reminders to complete the survey daily, in addition to in-person reminders from the researcher and other participants during the weekdays. Text messaging and phone calls are used daily for communication and accountability in the military therefore service members know to check their phones and respond in a timely manner, which may have also contributed to the higher compliance rate. Surveys sent on weekdays were completed more often than surveys sent on weekends, which may have been due to the lack of interaction with the program and no in-person reminders. Further, overall survey completion slightly declined from week 1 to week 3. This could have been partially because the novelty of using the app wore off in addition to survey fatigue as reported in previous research (Okifuji,

Bradshaw, Donaldson, & Turk, 2011; Ono et al., 2019). In addition, by week 3, the novelty of the program itself may have worn off as well. Future research should explore ways to enhance compliance with EMA surveys over time (i.e., incentives) and weekends compared to weekdays.

The use of EMA successfully yielded fine-tuned insights into participants' pain trajectories, psychosocial well-being, and attitudes toward the IOP. The importance of social support for mitigating pain, improving function and quality of life in those with persistent pain has been demonstrated in the literature (Jamison & Virts, 1990; Kerns, Rosenberg, & Otis, 2002; Lopez-Martinez et al., 2008). In this study, the majority of participants reported receiving social support during the weekdays but less than half of the time during the two weekends while in the program. No specific education on social support was provided during the intervention but participants were highly encouraged during goal setting to have positive interactions with their family members and friends on the weekends. A more distinct educational component about the types and importance of social support and how to employ it in daily life may be a valuable addition to the intensive treatment program.

Esteem support was the most frequently reported type of social support and the participants found the social support they received to be beneficial majority of the time. During the program, participants received frequent encouragement, expression of confidence and motivation from the providers and other participants which may have contributed to the reported frequency of esteem support. Future research should evaluate the components that target this type of support and explore all other types of support to

determine how to best target them and whether they are beneficial in management of persistent pain.

Daily stress levels varied throughout the three-week intervention with no trends noted. Several participants noted one or two spikes in stress levels however, we did not inquire about the sources of stress in our survey. Numerous factors could have contributed to the stress such as program demands, pain experienced, or events outside of the program such as a child's or own sickness, work stress or other life events. Capturing the experience of stress may be useful for timely intervention, mitigation, and assessing its relationship to pain. Self-reported pain intensity was also highly variable in our sample and most participants did not demonstrate a consistent change in one direction throughout the program. The three-week timeframe may have been too short to result in significant pain intensity changes especially for individuals who have had pain for years. A unidimensional tool such as a numerical pain intensity may not be the most appropriate measure assessing persistent pain (Robinson-Papp et al., 2015; Sullivan & Ballantyne, 2016). In addition, participants experienced soreness and other aches and pains due to a substantial increase in exercise while in the program. Future research should differentiate the causes of pain and other symptoms to gain greater understanding of self-reported pain. Due to the biopsychosocial nature of persistent pain, assessing additional components of individual experience such as physical performance, mood, sleep, and fear-avoidance beliefs can provide a much more informative assessment on how an individual is functioning with pain and should also be considered in future research using EMA for monitoring during an intensive treatment program.

The majority of the participants reported progress toward their goals on most days and very few reported taking additional, non-opioid medications due to increased pain while in the program while most were able to self-manage with techniques they learned in the program such as foam rolling, stretching, meditation or other relaxation techniques. This supports previous research that shows individuals with persistent pain often discover they can be much more functional and active after going through an interdisciplinary treatment program regardless of changes in self-reported pain intensity (Day et al., 2017; Gatchel et al., 2009).

Active (i.e., yoga, aquatics, advanced exercise) and passive (i.e., massage, chiropractic treatment) treatment techniques were frequently reported as beneficial by participants. Despite increased pain with some intervention components such as circuit training or morning physical training, they were still considered beneficial by the participants. The increased pain experienced may have been different from their persistent pain (i.e., soreness), or the participants were integrating the knowledge acquired in the program with decreased fear of movement and reinjury. Future research should explore attitudes about the program components and their effects on perception and management of pain in more depth to assess effectiveness of individual components.

There were several limitations in this study. The sample was small and included only military service members which is a specific population and results may not be applicable to other programs or populations. In addition, we were not able to confirm the accuracy of sessions the participants reported they attended. It is possible, they did not check all of the sessions they attended on any given day or checked ones they did not attend. Pain levels showed high variability but the types of pain were not differentiated

(i.e., soreness from exercise vs. persistent pain symptoms) and future research should distinguish these symptoms to better understand the intervention effects. Furthermore, we did not ask about the sources of stress and social support which could have provided additional insight into the psychosocial components of pain for the participants. Future research can use this smartphone application for daily monitoring and further investigation of additional components associated with persistent pain such as mood, sleep, function, sources of social support and coping skills. Monitoring not only during the intervention but for a time period after completion of the program would add additional ecological validity and assessment of changes once individuals return to their natural home and work environment. Furthermore, integrating EMA into a medical record platform would allow providers to easily access the information and incorporate it into daily decision-making during the program and at follow-ups. EMA could help identify important factors affecting pain management and progress in the program, leading to treatment refinements or other more appropriate interventions. Healthcare providers have shown interest in using electronic diaries for patients with persistent pain but often do not have time in their busy schedules to view them on platforms other than the patients' medical records (Bhavnani, Narula, & Sengupta, 2016; Marceau, Link, Smith, Carolan, & Jamison, 2010).

Conclusion

Smartphone application use for monitoring daily self-reported pain, psychosocial indicators and attitudes during an intensive outpatient program for persistent pain was feasible and acceptable among military service members. EMA can be used by active duty service members in the future to gain additional insights into pain management

experiences during and after completion of IOP and may be applicable across other situations among this target population.

Table 4.11. Demographic characteristics of the sample (n=22)

	Range	Mean (SD) or (N)%
Age	21-51	28.23 (7.44)
Time in service*	1-29	8.27 (6.78)
Pain duration*	.33-8	3.66 (2.78)
Pain at start of IOP	3-7	5.18 (1.59)
Pain at end of IOP	0-8	4.36 (2.15)
Gender		
Male		(13) 59.1
Female		(9) 40.9
Military Component		
Army[1]		(15) 68.1
Air Force		(5) 22.7
Navy		(2) 9.1
Military Rank		
Enlisted		(20) 90.9
Officer[2]		(2) 9.1
Marital Status		
Married		(18) 81.8
Single[3]		(4) 18.1
No deployments		(13) 59.1

*in years; [1]Army, Army Reserve; [2]warrant officers; [3]single and divorced

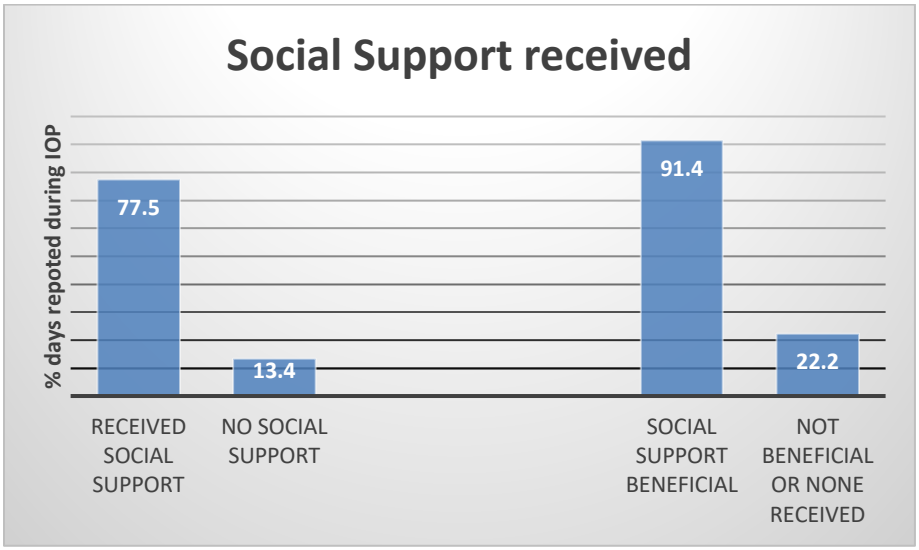

Figure 4.1. Social support received and benefit reported daily by participants during the 3-week IOP (n=22)

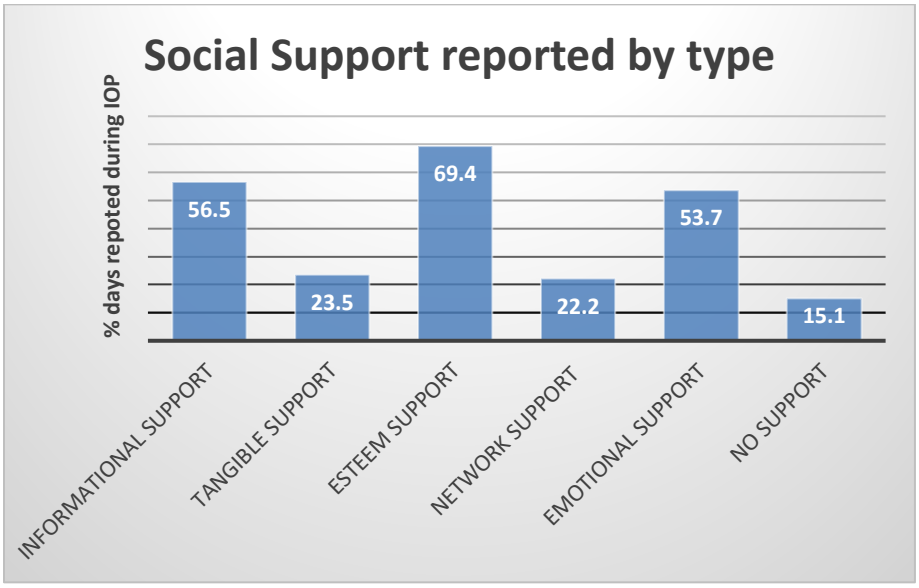

Figure 4.2. Social support by type, reported daily by participants during the 3-week IOP (n=22)

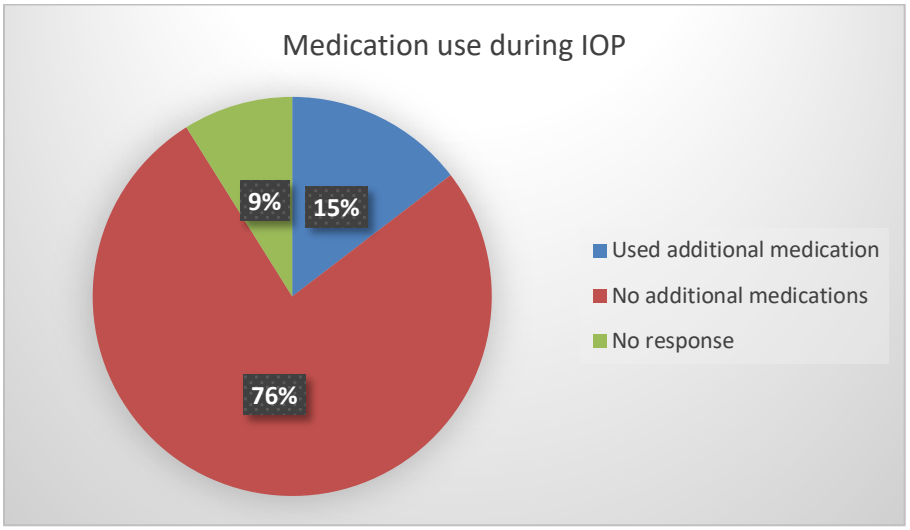

Figure 4.3. Additional medication use reported daily by participants during the 3-week IOP (n=22)

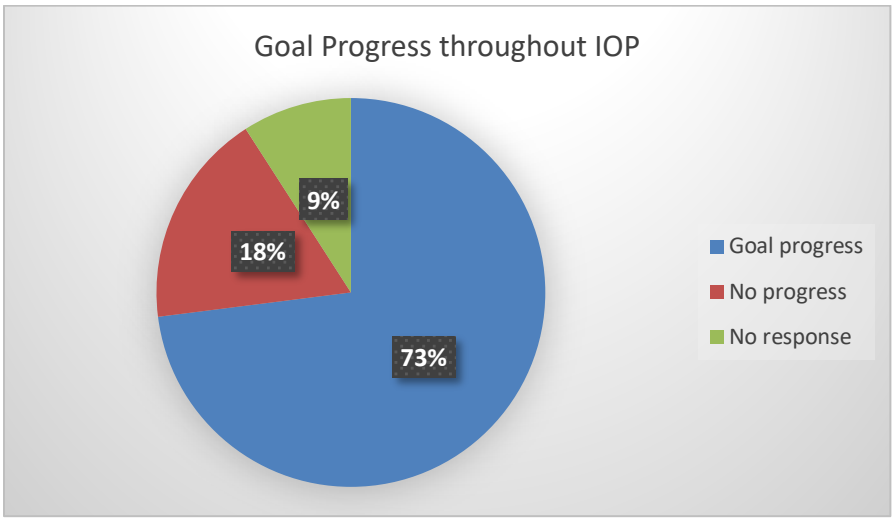

Figure 4.4. Goal progress reported daily by participants during the 3-week IOP (n=22)

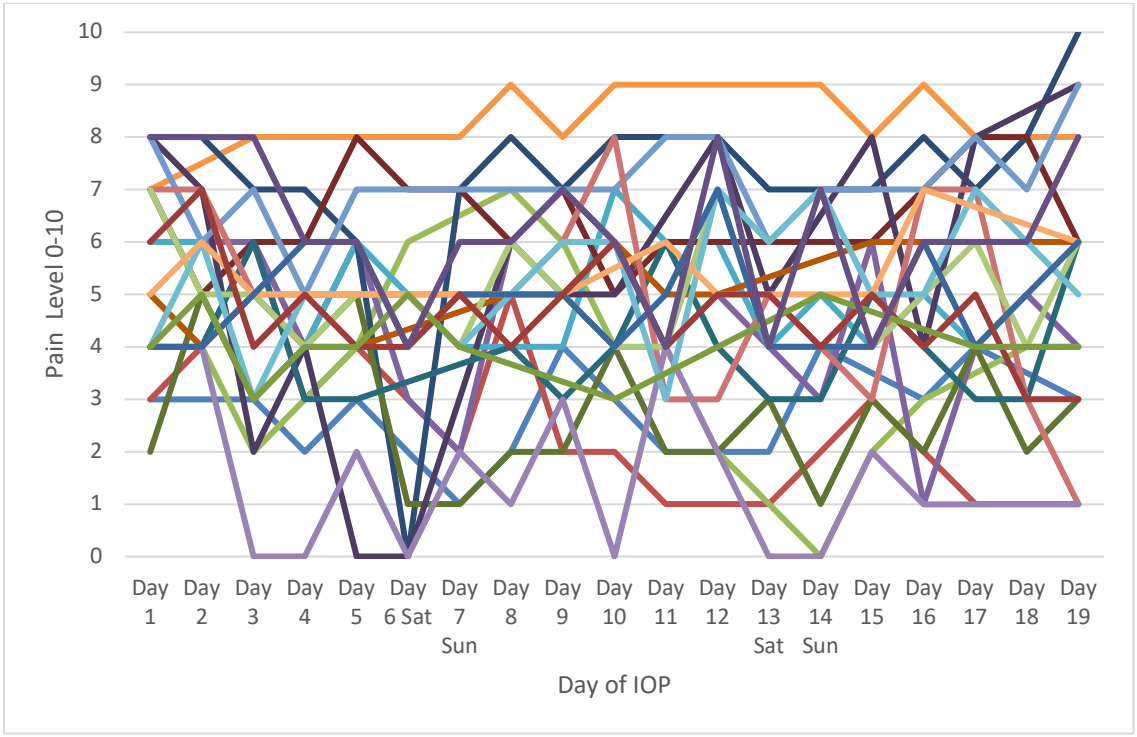

Figure 4.5. Daily pain levels reported by participant, during the 3-week IOP (n=22)

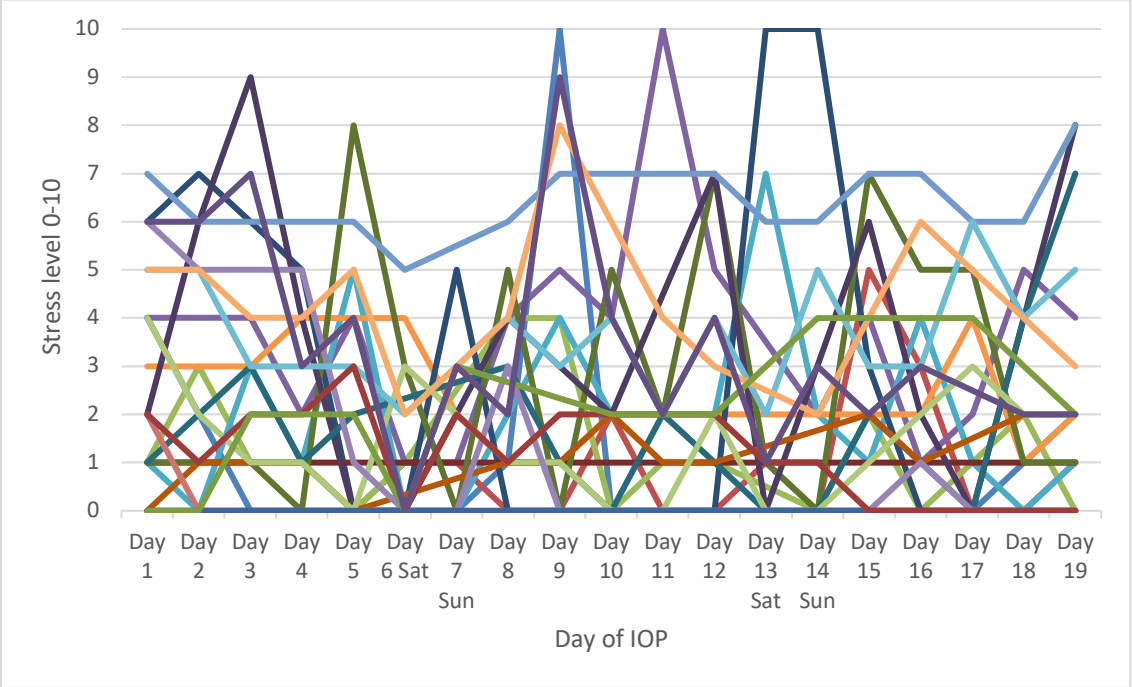

Figure 4.6. Daily stress levels (0-10) reported by participant, during the 3-week IOP (n=22)

Table 4.12. Participants reporting benefit, increased and decreased pain, average pain and stress levels as related to individual intervention components (n=22)

		Frequency (percent)			Pain level 0-10		Stress level 0-10	
Intervention	Total reported	Reported benefit	Increased pain	Decreased pain	Same day	Next day	Same day	Next day
Massage	46	35 (76)	0 (0)	41 (89)	4.91	5	2.61	1.93
Yoga	101	68 (67)	28 (28)	48 (48)	5.06	4.68	2.19	2.34
Chiropractor	100	62 (62)	2 (2.0)	70 (70)	5	4.81	2.3	2.10
Acupuncture	40	24 (60)	3 (7.5)	22 (55)	4.95	4.63	1.90	1.61
Aquatic therapy	98	58 (59)	15 (15)	19 (19)	4.84	4.99	2.08	2.15
Circuit Training	101	54 (53)	58 (57)	3 (3.0)	5.14	4.51	2.28	2.09
Advanced Exercise	88	45 (51)	42 (48)	6 (6.8)	5.06	4.28	2.42	2.08
Morning PT	148	72 (49)	95 (64)	1 (0.7)	5.20	4.76	2.32	2.01
Sleep Education	46	22 (48)	0 (0)	6 (13)	4.41	4.49	1.67	1.84
Goal Setting	105	45 (43)	1 (0.9)	8 (7.6)	5.17	4.78	2.27	1.85
Soldier Skills	77	27 (35)	51 (66)	1 (1.3)	4.75	5	2.14	2.27
Meditation	216	73 (34)	4 (1.9)	49 (23)	5.02	4.83	2.23	2.10
Behavioral Health	138	33 (24)	0 (0)	14 (10)	5.17	4.80	2.23	2.02

Notes: PT: physical training

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CHAPTER 5

SUMMARY, IMPLICATIONS AND RECOMMENDATION

Summary of Major Findings

This purpose of this study was to gain a deeper understanding of the experience of persistent pain in U.S. military service members attending an interdisciplinary intensive outpatient program, using a mixed-methods design. The qualitative study involved semi-structured interviews with patients and staff in the program in addition to the researcher's participation and observation of the program. The research questions and interview guides were guided by a literature review, conceptual framework and the researcher's clinical experience. The specific aim of this study was to gain insight into the process of change in the understanding of persistent pain through consideration of past and present experiences, psychosocial factors, personal and work relationships and stressors, attitudes, goals and expectations.

Based on the interviews and observation, five categories of participants emerged during analysis: (1) participants already well-versed in many of the biopsychosocial aspects of pain, fine-tuning their skills; (2) participants with life-altering realizations changing their lives in all aspects during the program; (3) participants with partial buy-in focused more toward the physical function and performance; (4) participant with partial buy-in focused more on the psychosocial changes; and (5) participants for whom the

biomedical model prevailed and despite some positive changes, the end result was seen as a failure to satisfactorily address their condition.

Participants who came into the program with knowledge and understanding of the biopsychosocial model of pain still benefitted from attending by fine tuning their knowledge and functional skills. Most benefit was reported by the participants who came to the program with no significant knowledge about persistent pain but with an open mind toward all aspects of the intervention, motivation to make changes across all aspects of their lives, and were in good physical condition. Participants more focused on improving physical performance showed more skepticism toward the behavioral and mental components of the treatment program. While skepticism may have been present at the beginning of the program in participants across the emergent categories, it was more pronounced throughout the program in the physical performance focused group. Participants more focused on their psychosocial wellbeing, noted greater understanding and acceptance of pain, improvements in relationships and usefulness of behavioral techniques to managing their pain. These participants made less progress in physical performance and reported greater uncertainty about returning to work. Least benefit was noted by the participants for whom the biomedical model, or the need to find a fix for or cure their persistent pain prevailed. These participants reported greatest relief from passive treatments such as chiropractic treatment, massage, or acupuncture, while dismissing active treatments (i.e., weightlifting, aquatic-based exercise, yoga) as painful and unhelpful.

The study showed that meaningful changes can take place in as little as three weeks for individuals who have had persistent pain for a few months or many years.

The military is a unique population which demands a high level of physical fitness as part of the job requirement. Service members in the program were pushed well-above their comfort zones and performed activities they may not have done in a long time. Those who gained most benefit, demonstrated improvement in physical performance and were also more open to and more likely to apply cognitive-behavioral techniques for self-management and acceptance while in the program. These participants were able to create a specific plan and integrate it into their daily lives after the program. Most service members who attend IOP are at a crossroads in their military career and the program is the last resort to stay in the military for some, while for others it may simply be a 'check the box' step before a medical evaluation board is initiated after all treatment options have been exhausted. Lack of improvement from treatment and ongoing limiting duty profiles can be a secondary gain for some service members, especially those with low job satisfaction because a medical evaluation board can help a service member leave the military sooner.

The skepticism toward the behavioral health components of the interdisciplinary intervention that was encountered was somewhat anticipated in our sample due to the general stigma toward any mental and behavioral health care in the military. The common perception among service members is that seeking behavioral health treatment leads to being perceived negatively by their command and peers in addition to the possibility of job opportunity denial, despite the attempt by the military to dispel most of these myths (Ben-Zeev et al., 2012; Green-Shortridge, 2007; Sharp et al., 2015). Our study found that even the most skeptical participants reported benefit from the behavioral health components of the program. The participants who were not planning on using any

of the behavioral methods after the program, reported they understood that those methods can be useful for others and found the discussions informative even if they were reluctant to state anything applied to them directly. These findings were consistent with a previous military study that demonstrated an increase in utilization of behavioral health after a functional restoration program similar to the IOP (Gatchel et al., 2009).

The second aim of this dissertation examined changes in patient activation or the level of knowledge, skill and confidence in self-management of one's health, using the Patient Activation Measure-13 (PAM-13). In our sample of 105 participants from an 18-month period, on average, patient activation increased from level 3 (taking action) to level 4 (staying the course under stress). Furthermore, regardless of patient activation level at baseline, all participants demonstrated improvement in patient activation at the completion of the program, moving to the next higher level except those who started the program at level 4 and could not move up to the next level. Those starting the program at level 4 PAM-13 demonstrated a small increase within the level but it was not statistically significant.

Participants who started the program at a higher PAM-13 score, had a lower fear of movement and reinjury as measured by the TSK-17. Similarly, those who completed the program at a higher PAM-13 score, had lower pain interference with activity, mood and stress, in addition to lower TSK-17 scores. This relationship was expected because by developing skill, knowledge and confidence to self-manage a condition, in this case persistent pain, individuals are more likely to experience decreased fear of movement and pain interference due to a better understanding of their condition and decreased perception of disability.

Physical fitness and capability are critical components of military service as reflected by the 40+ hours of high-level physical training and exercise during the 3-week program allowing the participants to test their limits and abilities to either jump start improvement in hopes of returning to full duty or lead to a medical evaluation board and a subsequent medical discharge. Our study found that on average, male participants improved significantly on all three physical performance events assessed. The average number of push-ups after the program was 41, while 42 push-ups is the minimum number required to pass the Army Physical Fitness Test for the youngest male age group (U.S. Army, 2012). Male participants also increased in the amount of weight they were able to deadlift and significantly improved on the shuttle run event. While the latter two events are currently only part of the physical fitness test during basic training, the Army is piloting a new Army Combat Fitness Test (ACFT) which will include a shuttle run and deadlift, making the events applicable for Soldiers, even though the participants were not recruits (U.S. Army TRADOC, 2018). Similarly, female participants significantly improved on their push-up and deadlift events with both average scores resulting in a passing grade on the Army's current fitness test and OPAT, respectively. Furthermore, female participants averaged over 160lbs deadlift at the end of the three-week program, greater than the minimum preliminary requirement for the new ACFT, which, if unchanged after pilot testing, will require a 140lbs deadlift on the gender-neutral test in order to pass (U.S. Army TRADOC, 2018). The shuttle run was the only event which did not significantly improve among female participants. This intensive outpatient program resulted in significant changes not only in the psychosocial components of pain but also demonstrated significant functional performance improvements in a short, three-week

timeframe indicating that individuals with persistent pain can make impactful changes in physical fitness and abilities in a short time. These findings are consistent with previous studies which showed improved function, decreased pain and pain interference in military population with persistent pain (Gatchel et al., 2009; Pujol et al., 2015).

The last aim of this research assessed the feasibility and acceptability of using a mobile application to monitor daily self-reported pain, psychosocial indicators and attitudes while receiving an intervention for persistent pain. Fifty percent of the 22 participants completed all 19 daily surveys with an overall compliance of 91.1%. Our compliance rate was higher compared to a recent meta-analysis which reported an EMA completion compliance rate of 85% in persistent pain research (Ono et al., 2019). All of the participants who responded to acceptability questions (68.2%) reported that answering the daily survey questions on a smartphone was an easy task to integrate at the end of the day and that they would also be willing to answer daily survey questions again. Pain and stress level trajectories showed high variability between and within participants throughout the 3 weeks. Neither trajectory demonstrated an upward or downward trend through the course of the program.

Participants reported receiving social support 77.5% of the days with significantly higher support during weekdays (85.7%) compared to weekends (46.6%). No specific education on social support was provided during the intervention but participants were highly encouraged during goal setting to have positive interactions with their family members and friends on the weekends. During the program, participants received frequent encouragement, expression of confidence and motivation from the providers and

other participants which may have contributed to the reported frequency of esteem support during the weekdays.

Majority of passive and active components of the program were considered beneficial regardless of whether they increased or decreased pain. Components such as circuit training or morning physical training increased pain more than 50% of the time but were still considered beneficial by the participants at least one third of the time. This may have been due to the participants differentiating the various types of pain they were experiencing (i.e., soreness vs. their persistent pain), a decrease in fear of movement and reinjury, and integration of the knowledge acquired in the program.

Strengths and Limitations

This research utilized a mixed-methods design that explored the process of change in military service members experiencing persistent pain. The qualitative study supported a previous study in veteran population which categorized participants based on experiences after attending a self-management program for persistent pain (Penney & Haro, 2019). This research focused on the process of change by interviewing participants at several time-points during the intervention and then categorizing the experiences. Majority of participants described at least some benefit from the intervention during the interviews which was supported by the quantitative, retrospective data showing improvements across all outcome measures as well as an improvement in confidence, skill and self-management, or the PAM-13.

Daily monitoring of psychosocial indicators, pain intensity and attitudes about the program was found to be feasible and acceptable with high compliance and participants

reporting willingness to perform daily assessments in the future. Using a device that participants already owned instead of issuing another device for the study decreased the burden on the participants and may have contributed to compliance (Burke et al., 2017).

The study sample used in specific aim 1 and 3 was from a small subset of the military population which may not be generalizable to all other military occupations because the participants in our study had similar, mostly sedentary jobs while the more physically demanding jobs such as combat arms (ie. infantry, field artillery) were not represented due to the location of the program. There was no long-term follow-up to determine the implications of the program after return to work. We also do not know how many of the participants stayed in the military and how many were medically discharged following the completion of IOP.

The data used for specific aim 2 was retrospective therefore we could not determine causal inferences. The participants analyzed were those who completed the program with no ability to compare participants who may have been dropped or quit the program for various reasons. The sample was small and outcome measures were limited to ones used by the intensive pain program. Data analysis compared only baseline and immediate post-program results but we did not analyze long-term follow-up data which should be further explored.

For specific aim 3, compliance with smartphone app data collection decreased overtime. We were not able to confirm the accuracy of sessions the participants reported they attended. It is possible, they did not check all of the sessions attended on any given day or checked ones they did not attend. Furthermore, we did not ask about the sources of

stress and social support which could have provided additional insight into the psychosocial components of pain for the participants.

Conclusion and Implications for Future Research

Through this dissertation study, we have gained a deeper understanding into the process of change in military service members with persistent pain participating in an interdisciplinary intensive outpatient program. Significant changes can take place in as little as 3 weeks even for individuals who have had persistent pain for many years. We learned about the participants' experience during the program and future research should address the participants' experiences after return to limited or full military duty to determine what skills and techniques from the program the participants found to be feasible and beneficial after IOP. The long-term process to return to the required level of physical ability, which is an imperative factor in military readiness, should also be further explored because while majority of IOP participants made progress in the program, few were ready to return to full duty with no limitations immediately after the program.

Through participant narrative and observed behavior, this research also unexpectedly found that basic functional movements, such as squats or proper lifting techniques and body mechanics were not established prior to the program, ideally at the onset of military service, despite the fact that most of the participants performed regular physical training with their units. Participants who have been in the military for several years reported learning how to properly perform movements and exercises for the first time during this program. This is critical information as the military continues to struggle with musculoskeletal injuries from job-related incidents or improper training. In the

Army alone, 50% of Soldiers are diagnosed with musculoskeletal injuries annually and more than half are due to lower extremity training injuries (U.S. Army Surgeon General Report, 2016). The Army is currently in the process of changing its physical fitness test from the Army Physical Fitness Test (APFT), which is graded on a scale based on age and sex, consisting of push-ups, sit-ups and a two mile run to a new Army Combat Fitness Test (ACFT) which is age and gender neutral and consists of six functional movements including a 3-repetition maximum deadlift, standing power throw, hand-release push-up, sprint-drag-carry, leg tuck on a pull up bar, and a 2-mile run, making the new test substantially more challenging and dependent on proper technique to minimize injury (U.S. Army TRADOC, 2018). The new test, which will go live in October 2020, has provided a sense of urgency to create a culture change in the way the Army performs physical training from the current, often ineffective training standards as seen in our qualitative research study and consistent with the researcher's prior clinical experience.

We also learned that patient activation improved after the intervention irrespective of the baseline PAM-13 level. While tailoring treatment to specific PAM-13 levels could prove to be beneficial and may need to be further explored, the group dynamics between participants of different PAM-13 levels may have provided the drive for improvement for all, with those at higher baseline PAM-13 scores motivating those with lower scores, as suggested by the IOP staff. All other outcome measures also improved after completion of the intervention which was consistent with the qualitative content that showed all participants reported gaining some benefit from IOP. No relationship was noted between baseline PAM-13 and the change in outcome measures which may have been due to the small sample and may need to be further investigated to determine whether baseline

patient activation had an effect on the individual outcomes in the program. In addition, future research should explore assessing patient activation following the program to determine long-term effects, whether the improvements are sustained and related to outcomes upon return to the work environment full-time. Previous research has shown that PAM scores may be sustained over time but may also fluctuate based not only on changes in an individual's chronic condition but also circumstances such as life and work stressors (Chubak et al., 2012; Hibbard et al., 2015).

Lastly, our research found that the use of a smartphone application to monitor pain intensity, attitudes and psychosocial indicators such as social support was feasible and acceptable among military service members and may be a valuable tool for additional monitoring of participant progress while in the pain program and beyond. EMA can provide additional information for a comprehensive assessment of one's persistent pain experience.

Majority of participants reported at least one type of social support during the weekdays but less than half of the time during the two weekends while in the program. The importance of social support in persistent pain has been demonstrated in literature (Jamison & Virts, 1990; Kerns et al., 2002; Lopez-Martinez et al., 2008). No specific education on social support was provided during the intervention and a more distinct educational component about the types and importance of social support may be a beneficial addition to the intensive treatment program. Network support was least frequently reported by participants in the program therefore additional focus on how to leverage this type of support from family, friends and community resources may empower individuals to better self-manage their persistent pain.

Healthcare providers have shown interest in using electronic diaries for patients with persistent pain but often do not have time in their busy schedules to view them on platforms other than the patients' medical records (Bhavnani et al., 2016; Marceau et al., 2010). Integrating EMA into electronic medical record platform should be further explored to maximize the usefulness of such tool in clinical practice by allowing providers easier access to the information and ability to incorporate it into daily decision-making during the treatment program and at follow-ups. In addition, daily monitoring of other components associated with persistent pain such as mood, sleep, function, sources of social support and coping skills utilized should be investigated. Monitoring not only during the intervention but for a time period after completion of the program would add additional ecological validity and assessment of changes once individuals return to their regular home and work environment.

In summary, this research addressed gaps in literature related the process of change and pertinent outcomes in service members undergoing an interdisciplinary intensive outpatient program. The study established categories of program participants and the process of change in each group, contributed new information regarding patient activation and pertinent outcomes especially physical capabilities that are imperative for military readiness, and demonstrated feasibility of monitoring various indicators using up-to-date technology which may improve comprehensive assessment and access to the information by providers. The research also identified avenues for future research to explore persistent pain understanding, monitoring and treatment options.

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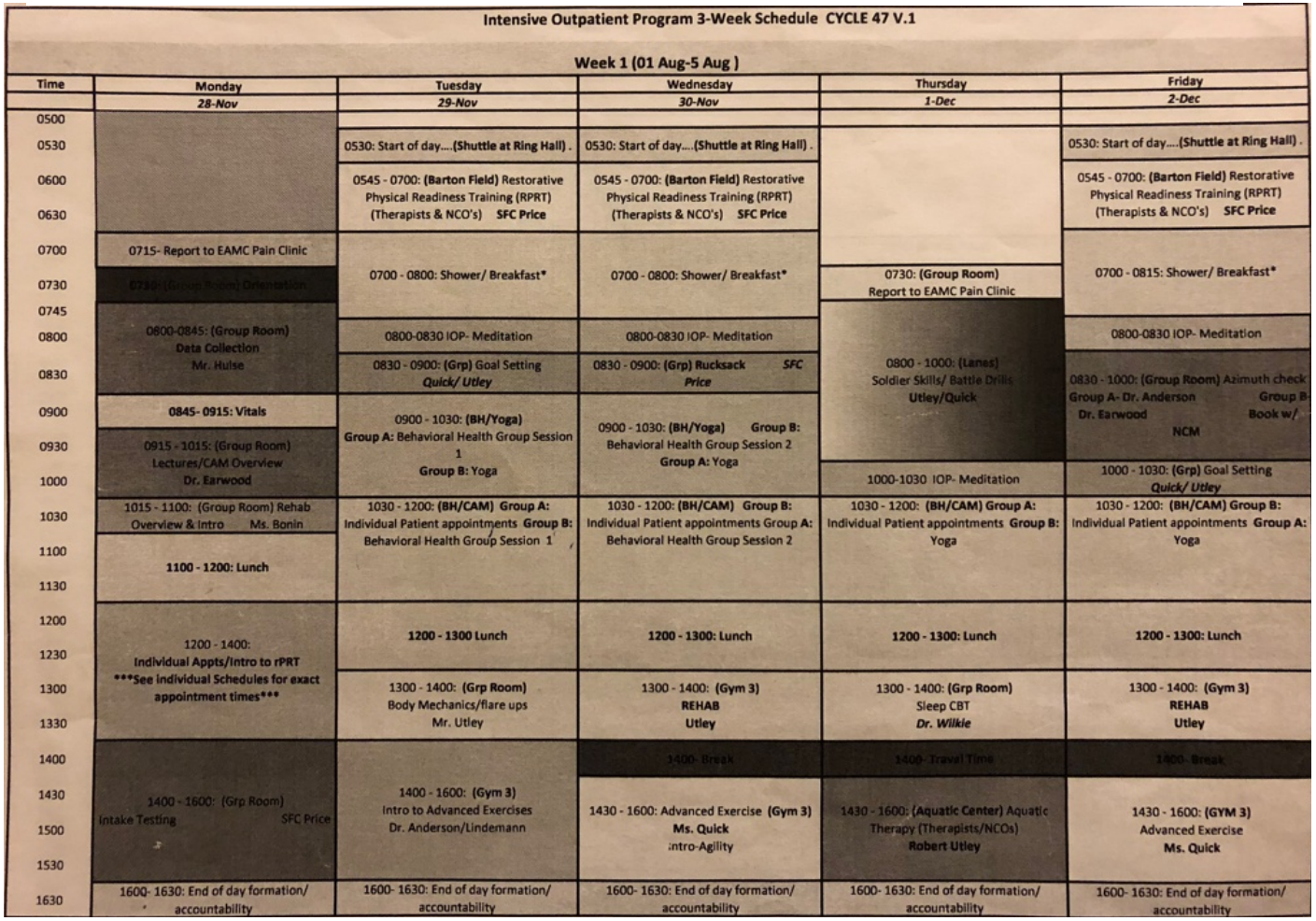
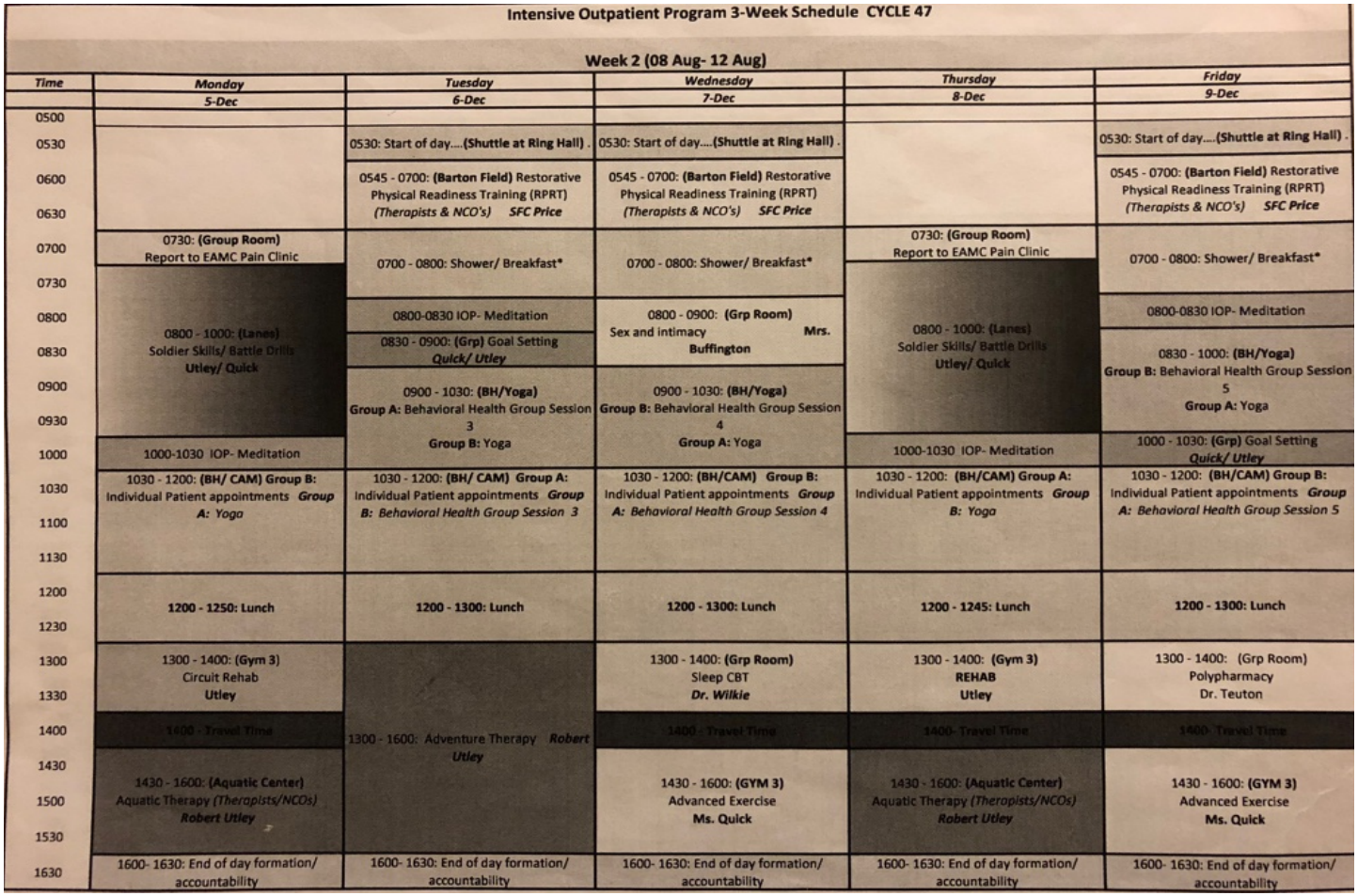
APPENDIX A- INTENSIVE OUTPATIENT PROGRAM 3-WEEK SCHEDULE



Intensive Outpatient Program 3-Week Schedule CYCLE 47 V.1

Week 1 (01 Aug-5 Aug)

Time	Monday	Tuesday	Wednesday	Thursday	Friday
	28-Nov	*29-Nov*	*30-Nov*	*1-Dec*	*2-Dec*
0500					
0530		0530: Start of day....**(Shuttle at Ring Hall)** .	0530: Start of day....**(Shuttle at Ring Hall)** .		0530: Start of day....**(Shuttle at Ring Hall)** .
0600		0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) (Therapists & NCO's) **SFC Price**	0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) (Therapists & NCO's) **SFC Price**		0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) (Therapists & NCO's) **SFC Price**
0630					
0700	0715- Report to EAMC Pain Clinic	0700 - 0800: Shower/ Breakfast*	0700 - 0800: Shower/ Breakfast*		
0730	0730: (Group Room) Orientation			0730: **(Group Room)** Report to EAMC Pain Clinic	0700 - 0815: Shower/ Breakfast*
0745					
0800	0800-0845: (Group Room) Data Collection Mr. Hulse	0800-0830 IOP- Meditation	0800-0830 IOP- Meditation		0800-0830 IOP- Meditation
0830		0830 - 0900: **(Grp)** Goal Setting ***Quick/ Utley***	0830 - 0900: **(Grp) Rucksack *SFC Price***	0800 - 1000: **(Lanes)** Soldier Skills/ Battle Drills **Utley/Quick**	0830 - 1000: (Group Room) Azimuth check Group A- Dr. Anderson Group B- Dr. Earwood Book w/ NCM
0900	**0845- 0915: Vitals**	0900 - 1030: **(BH/Yoga)** **Group A:** Behavioral Health Group Session 1 **Group B:** Yoga	0900 - 1030: **(BH/Yoga)** **Group B:** Behavioral Health Group Session 2 **Group A:** Yoga		
0930	0915 - 1015: (Group Room) Lectures/CAM Overview Dr. Earwood				
1000				1000-1030 IOP- Meditation	1000 - 1030: **(Grp)** Goal Setting ***Quick/ Utley***
1030	1015 - 1100: (Group Room) Rehab Overview & Intro Ms. Bonin	1030 - 1200: **(BH/CAM) Group A:** Individual Patient appointments **Group B:** Behavioral Health Group Session 1	1030 - 1200: **(BH/CAM) Group B:** Individual Patient appointments **Group A:** Behavioral Health Group Session 2	1030 - 1200: **(BH/CAM) Group A:** Individual Patient appointments **Group B:** Yoga	1030 - 1200: **(BH/CAM) Group B:** Individual Patient appointments **Group A:** Yoga
1100	**1100 - 1200: Lunch**				
1130					
1200	1200 - 1400: **Individual Appts/Intro to rPRT** ***See individual Schedules for exact appointment times***	**1200 - 1300 Lunch**	**1200 - 1300: Lunch**	**1200 - 1300: Lunch**	**1200 - 1300: Lunch**
1230					
1300		1300 - 1400: **(Grp Room)** Body Mechanics/flare ups Mr. Utley	1300 - 1400: **(Gym 3)** **REHAB** **Utley**	1300 - 1400: **(Grp Room)** Sleep CBT ***Dr. Wilkie***	1300 - 1400: **(Gym 3)** **REHAB** **Utley**
1330					
1400	1400 - 1600: (Grp Room) Intake Testing SFC Price	1400 - 1600: **(Gym 3)** Intro to Advanced Exercises Dr. Anderson/Lindemann	1400- Break	1400- Travel Time	1400- Break
1430			1430 - 1600: Advanced Exercise **(Gym 3)** **Ms. Quick** Intro-Agility	1430 - 1600: **(Aquatic Center)** Aquatic Therapy (Therapists/NCOs) **Robert Utley**	1430 - 1600: **(GYM 3)** Advanced Exercise **Ms. Quick**
1500					
1530					
1630	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability



Intensive Outpatient Program 3-Week Schedule CYCLE 47

Week 2 (08 Aug- 12 Aug)

Time	Monday 5-Dec	Tuesday 6-Dec	Wednesday 7-Dec	Thursday 8-Dec	Friday 9-Dec
0500					
0530		0530: Start of day....**(Shuttle at Ring Hall)** .	0530: Start of day....**(Shuttle at Ring Hall)** .		0530: Start of day....**(Shuttle at Ring Hall)** .
0600		0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) *(Therapists & NCO's)* ***SFC Price***	0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) *(Therapists & NCO's)* ***SFC Price***		0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) *(Therapists & NCO's)* ***SFC Price***
0630					
0700	0730: **(Group Room)** Report to EAMC Pain Clinic	0700 - 0800: Shower/ Breakfast*	0700 - 0800: Shower/ Breakfast*	0730: **(Group Room)** Report to EAMC Pain Clinic	0700 - 0800: Shower/ Breakfast*
0730	0800 - 1000: **(Lanes)** Soldier Skills/ Battle Drills **Utley/ Quick**			0800 - 1000: **(Lanes)** Soldier Skills/ Battle Drills **Utley/ Quick**	
0800		0800-0830 IOP- Meditation	0800 - 0900: **(Grp Room)** Sex and intimacy **Mrs. Buffington**		0800-0830 IOP- Meditation
0830		0830 - 0900: **(Grp)** Goal Setting ***Quick/ Utley***			0830 - 1000: **(BH/Yoga)** **Group B:** Behavioral Health Group Session 5 **Group A:** Yoga
0900		0900 - 1030: **(BH/Yoga)** **Group A:** Behavioral Health Group Session 3 **Group B:** Yoga	0900 - 1030: **(BH/Yoga)** **Group B:** Behavioral Health Group Session 4 **Group A:** Yoga		
0930					
1000	1000-1030 IOP- Meditation			1000-1030 IOP- Meditation	1000 - 1030: **(Grp)** Goal Setting ***Quick/ Utley***
1030	1030 - 1200: **(BH/ CAM) Group B:** Individual Patient appointments ***Group A:*** *Yoga*	1030 - 1200: **(BH/ CAM) Group A:** Individual Patient appointments ***Group B:*** *Behavioral Health Group Session 3*	1030 - 1200: **(BH/CAM) Group B:** Individual Patient appointments ***Group A:*** *Behavioral Health Group Session 4*	1030 - 1200: **(BH/CAM) Group A:** Individual Patient appointments ***Group B:*** *Yoga*	1030 - 1200: **(BH/CAM) Group B:** Individual Patient appointments ***Group A:*** *Behavioral Health Group Session 5*
1100					
1130					
1200	**1200 - 1250: Lunch**	**1200 - 1300: Lunch**	**1200 - 1300: Lunch**	**1200 - 1245: Lunch**	**1200 - 1300: Lunch**
1230					
1300	1300 - 1400: **(Gym 3)** Circuit Rehab **Utley**	1300 - 1600: Adventure Therapy ***Robert Utley***	1300 - 1400: **(Grp Room)** Sleep CBT ***Dr. Wilkie***	1300 - 1400: **(Gym 3)** **REHAB** **Utley**	1300 - 1400: (Grp Room) Polypharmacy Dr. Teuton
1330					
1400	1400 - Travel Time		1400 - Travel Time	1400- Travel Time	1400- Travel Time
1430	1430 - 1600: **(Aquatic Center)** Aquatic Therapy *(Therapists/NCOs)* ***Robert Utley***		1430 - 1600: **(GYM 3)** Advanced Exercise **Ms. Quick**	1430 - 1600: **(Aquatic Center)** Aquatic Therapy *(Therapists/NCOs)* ***Robert Utley***	1430 - 1600: **(GYM 3)** Advanced Exercise **Ms. Quick**
1500					
1530					
1630	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability

Intensive Outpatient Program 3-Week Schedule CYCLE 47

Week 2 (08 Aug- 12 Aug)

Time	Monday 5-Dec	Tuesday 6-Dec	Wednesday 7-Dec	Thursday 8-Dec	Friday 9-Dec
0500					
0530		0530: Start of day....**(Shuttle at Ring Hall)** .	0530: Start of day....**(Shuttle at Ring Hall)** .		0530: Start of day....**(Shuttle at Ring Hall)** .
0600		0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) *(Therapists & NCO's)* ***SFC Price***	0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) *(Therapists & NCO's)* ***SFC Price***		0545 - 0700: **(Barton Field)** Restorative Physical Readiness Training (RPRT) *(Therapists & NCO's)* ***SFC Price***
0630					
0700	0730: **(Group Room)** Report to EAMC Pain Clinic	0700 - 0800: Shower/ Breakfast*	0700 - 0800: Shower/ Breakfast*	0730: **(Group Room)** Report to EAMC Pain Clinic	0700 - 0800: Shower/ Breakfast*
0730					
0800	0800 - 1000: **(Lanes)** Soldier Skills/ Battle Drills **Utley/ Quick**	0800-0830 IOP- Meditation	0800 - 0900: **(Grp Room)** Sex and intimacy **Mrs. Buffington**	0800 - 1000: **(Lanes)** Soldier Skills/ Battle Drills **Utley/ Quick**	0800-0830 IOP- Meditation
0830		0830 - 0900: **(Grp)** Goal Setting ***Quick/ Utley***			0830 - 1000: **(BH/Yoga)** **Group B:** Behavioral Health Group Session 5 **Group A:** Yoga
0900		0900 - 1030: **(BH/Yoga)** **Group A:** Behavioral Health Group Session 3 **Group B:** Yoga	0900 - 1030: **(BH/Yoga)** **Group B:** Behavioral Health Group Session 4 **Group A:** Yoga		
0930					
1000	1000-1030 IOP- Meditation			1000-1030 IOP- Meditation	1000 - 1030: **(Grp)** Goal Setting ***Quick/ Utley***
1030	1030 - 1200: **(BH/ CAM) Group B:** Individual Patient appointments ***Group A:*** *Yoga*	1030 - 1200: **(BH/ CAM) Group A:** Individual Patient appointments ***Group B:*** *Behavioral Health Group Session 3*	1030 - 1200: **(BH/CAM) Group B:** Individual Patient appointments ***Group A:*** *Behavioral Health Group Session 4*	1030 - 1200: **(BH/CAM) Group A:** Individual Patient appointments ***Group B:*** *Yoga*	1030 - 1200: **(BH/CAM) Group B:** Individual Patient appointments ***Group A:*** *Behavioral Health Group Session 5*
1100					
1130					
1200	**1200 - 1250: Lunch**	**1200 - 1300: Lunch**	**1200 - 1300: Lunch**	**1200 - 1245: Lunch**	**1200 - 1300: Lunch**
1230					
1300	1300 - 1400: **(Gym 3)** Circuit Rehab **Utley**	1300 - 1600: Adventure Therapy ***Robert Utley***	1300 - 1400: **(Grp Room)** Sleep CBT ***Dr. Wilkie***	1300 - 1400: **(Gym 3)** **REHAB** **Utley**	1300 - 1400: (Grp Room) Polypharmacy Dr. Teuton
1330					
1400	1400 - Travel Time		1400 - Travel Time	1400- Travel Time	1400- Travel Time
1430	1430 - 1600: **(Aquatic Center)** Aquatic Therapy *(Therapists/NCOs)* ***Robert Utley***		1430 - 1600: **(GYM 3)** Advanced Exercise **Ms. Quick**	1430 - 1600: **(Aquatic Center)** Aquatic Therapy *(Therapists/NCOs)* ***Robert Utley***	1430 - 1600: **(GYM 3)** Advanced Exercise **Ms. Quick**
1500					
1530					
1630	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability	1600- 1630: End of day formation/ accountability

APPENDIX B – CONSENT FORMS FOR PATIENT PARTICIPANTS AND STAFF PARTICIPANTS AND HIPAA AUTHORIZATION FOR PATIENT PARTICIPANTS

Consent to Participate in Research (Patient Participants), Version 2.4
7/01/2018
D.D. Eisenhower Army Medical Center, Fort Gordon, GA

1. PROTOCOL TITLE: The Experience of Chronic Pain in Military Service Members Participating in an Army Intensive Outpatient Pain Program (IOP).

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.

You will receive standard medical treatment in the Intensive Outpatient Program. Your treatment will be altered based on this research study. Your decision will not affect your current or future care at D.D. Eisenhower Army Medical Center, Fort Gordon, GA.

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 participating in the Intensive Outpatient Program for chronic pain at the Interdisciplinary Pain Management Center. The purpose of this research study is to better understand the perception of chronic pain in IOP participants. More specifically, we will be focusing on the experience in the program and changes in your perception and self-management of chronic pain.

There will be approximately 20 patient participants and 5 staff members taking part in the study at DDEAMC Interdisciplinary Pain Management Center, over a period of the next 6-8 months.

Your participation in the study will take place during your time in the IOP and will take no more than 2.5-3 hours of your time spread out throughout the 3-week duration of the IOP.

RHC-A IRB
IRB NUMBER: DDEAMC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

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

You will be asked to complete two face-to-face interviews that will take no more than 20-30 minutes each at the beginning and at the end of the IOP. The interviews will take place during a break in IOP, at the end of the day, or at another time and place convenient for you. You will also receive a follow-up phone call after completion of each week of the program that will take no more than 5-10 minutes to answer several questions about how your week went and your progress. You will also be asked to answer several questions about your pain and progress daily, at the end of the day, on a smartphone application (PACO App)or online (www.pacoapp.com) which will take less than 1 minute.

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

There are minimal anticipated risk associated with this study. If you find any of the questions uncomfortable to answer, you may choose not to respond.

Although efforts are made to protect your research study records, there is always a risk that someone could get access to the personal information stored while the study is ongoing but after the completion of the study, the master key with personal information will be deleted and only de-identified data will be stored. In addition, the master key will be stored separately from the de-identified data for the duration of the study.

5. 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 include better understanding of chronic pain and improved treatment program to support the health and performance of Soldiers.

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

Your alternative is not to participate in this research.

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

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

8. ARE THERE COSTS FOR PARTICIPATING IN THIS RESEARCH?

RHC-A IRB
IRB NUMBER: DDEAMC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

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

9. WHO IS CONDUCTING THIS RESEARCH?

The study is being conducted by University of South Carolina and Army Long Term Health Education Training Program doctoral student, Barbara Bujak in order to fulfill the requirements for the Degree of Philosophy (PhD) in Health Promotion, Education and Behavior at Arnold School of Public Health, University of South Carolina, Columbia SC.

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

This study is funded through the Army Long Term Health Education Training Program.
Oversight is provided by Dr. Christine Blake, professor at University of South Carolina, Columbia SC.

11. SOURCE OF FUNDING:

This study is funded through the Army Long Term Health Education Training Program.

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

MAJ Barbara Bujak, SP Corps

13. LOCATION OF THE RESEARCH:

Interdisciplinary Pain Management Center, D.D. Eisenhower Army Medical Center, Fort Gordon, GA

14. DISCLOSURE OF FINANCIAL INTERESTS AND OTHER PERSONAL ARRANGEMENTS:

There are no financial interests or other personal arrangements to anyone associated with the study.

15. 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/eforms/dd2005.pdf.

Procedures to protect the confidentiality of the data in this study include but are not limited to:
You will never be personally identified in any presentation of this data. All data will be de-identified for analysis. We will store your responses with an identifier as a precaution to make sure your information remains confidential. There will be a master key linking your name to the identifier stored in a password encrypted file on a password encrypted computer and will be destroyed after all data collected at various points is linked by each identifier at the completion of the study. Any and all hand-written notes will be kept in a locked filing cabinet at a locked office at the University of South Carolina and will be shredded at the completion of the study. All de-identified data including audio recordings, transcripts, observation notes will be stored indefinitely in an encrypted folder on the PI's password protected computer for any additional follow-on secondary data analysis after the research project is completed. No other copies of the data will be made or stored elsewhere. While we will not be able to control the information collected by the smartphone application including device information, phone number, and usage, we will provide you with a confidential study name and study email address (e.g., study_email@gmail.com) to use that will not be associated with your name or personal email address.

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.

MAJ Barbara Bujak 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.

16. LONG TERM USE OF DATA

The investigator has requested to save selected data collected from your participation in this research study for possible use in future research. All data saved will be de-identified and the master key linking the personal information to identifiers will be deleted. This future research may be in the same area as the original study or it may be for a different kind of study.

RHC-A IRB
IRB NUMBER: DDEAMC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

Any future research using your retained data will require a research protocol for the proposed study approved by an Institutional Review Board (IRB) (a committee responsible for protecting research participants) or other authorized official responsible for protecting human subjects of research. The data protections for privacy and confidentiality described in this consent form will apply to any future use of your stored data.

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

N/A

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 contact the PI, Barbara Bujak at 703-927-7209. All data collected up to the point of your withdrawal will be analyzed for the study unless you choose to withdraw all of your previously collected data. There are no consequences for withdrawing from the study at any time.

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. INCIDENTAL FINDINGS

N/A

21. CONTACT INFORMATION:

Principal Investigator (PI)

RHC-A IRB
IRB NUMBER: DDEAMC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

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

Principal Investigator: MAJ Barbara Bujak
Phone: 703-927-7209
Mailing Address: 915 Greene St. Ste 536, Columbia, SC 29201

Institutional Review Board (IRB) Office
If you have any questions about your rights as a research participant or if you have concerns or complaints about the research study, please contact the IRB Office at:

Regional Health Command – Atlantic
9275 Doerr Road
Fort Belvoir, Virginia 22060-2204
usarmy.belvoir.medcom-rhc-a.mbx.irb-office@mail.mil
(706)787-8053 or (910) 907-8351

IF THERE IS ANY PORTION OF THIS DOCUMENT THAT YOU DO NOT UNDERSTAND, ASK THE INVESTIGATOR BEFORE SIGNING. YOU MAY CONSULT WITH YOUR PERSONAL PHYSICIAN OR LEGAL ADVISOR, IF YOU WISH.

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

Please initial the sentences that reflect your choices, and then sign below:

_____ I do not authorize the storage of data collected as a part of this study for future use in research studies.

_____ I authorize the storage of data collected as a part of this study for future use in research studies.

_____I DO / DO NOT consent to an audio-recording. (circle one)

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)

RHC-A IRB
IRB NUMBER: DDEAMC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

_____
Printed Name of Administering Individual

_____ _____
Signature of Administering Individual Date

RHC-A IRB
IRB NUMBER: DDEANC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

1. PROTOCOL TITLE: The Experience of Chronic Pain in Military Service Members Participating in an Army Intensive Outpatient Pain Program.

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 work at D.D. Eisenhower Army Medical Center, Fort Gordon, GA.

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 a staff member in the Intensive Outpatient Program (IOP) for chronic pain at the Interdisciplinary Pain Management Center. The purpose of this research study is to better understand the perception of chronic pain in IOP participants. More specifically, we will be focusing on their experience in the program and changes in perception and self-management of chronic pain.

There will be about 5 staff members and 20 patient participants taking part in the study at DDEAMC Interdisciplinary Pain Management Center, over a period of the next 6-8 months.

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

You will be asked to complete one face-to-face interviews that will take no more than 20-30 minutes. The interview will take place during a break in IOP, at the end of the day, or at another time and place convenient for you. The interview will be completed by the principal investigator, Barbara Bujak.

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

There is no known risk associated with this study. If you find any of the questions uncomfortable to answer, you may choose not to respond.

5. 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 include better understanding of chronic pain and improved treatment program to support the health and performance of Soldiers.

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

Your alternative is not to participate in this research.

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

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

8. ARE THERE COSTS FOR PARTICIPATING IN THIS RESEARCH?

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

9. WHO IS CONDUCTING THIS RESEARCH?

The study is being conducted by University of South Carolina and Army Long Term Health Education Training Program doctoral student, Barbara Bujak in order to fulfill the requirements for the Degree of Philosophy (PhD) in Health Promotion, Education and Behavior at Arnold School of Public Health, University of South Carolina, Columbia SC.

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

This study is funded through the Army Long Term Health Education Training Program.
Oversight is provided by Dr. Christine Blake, professor at University of South Carolina, Columbia SC.

11. SOURCE OF FUNDING:

RHC-A IRB
IRB NUMBER: DDEAMC17009
IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

This study is funded through the Army Long Term Health Education Training Program.

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

MAJ Barbara Bujak, SP Corps – Principal Investigator

13. LOCATION OF THE RESEARCH:

Interdisciplinary Pain Management Center, D.D. Eisenhower Army Medical Center, Fort Gordon, GA

14. DISCLOSURE OF FINANCIAL INTERESTS AND OTHER PERSONAL ARRANGEMENTS:

There are no financial interests or other personal arrangements to anyone associated with the study.

15. 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/eforms/dd2005.pdf.

Procedures to protect the confidentiality of the data in this study include but are not limited to:
We will not share your responses with anyone except for members of the research team. You will never be personally identified in any presentation of this data. We will store your responses with an identifier (i.e. 'staff_01) as a precaution to make sure your information remains confidential. No identifiable data will be stored. Any and all hand-written notes will be kept in a locked filing cabinet at a locked office at the University of South Carolina and will be shredded at the completion of the study. All de-identified data including audio recordings and transcripts will be stored in an encrypted folder on the PI's password protected computer for any additional follow-on secondary data analysis after the research project is completed. No other copies of the data will be made or stored elsewhere. All data will be de-identified from the start including analysis.

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.

16. LONG TERM USE OF DATA

The investigator has requested to save selected data collected from your participation in this research study for possible use in future research. All data will be de-identified and no personal information will be stored. Future research may be in the same area as the original study or it may be for a different kind of study.

Any future research using your retained data will require a research protocol for the proposed study approved by an Institutional Review Board (IRB) (a committee responsible for protecting research participants) or other authorized official responsible for protecting human subjects of research. The data protections for privacy and confidentiality described in this consent form will apply to any future use of your stored data.

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

N/A

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 contact the PI, Barbara Bujak at 703-927-7209. All data collected up to the point of your withdrawal will be analyzed for the study unless you choose to withdraw all of your previously collected data. There are no consequences for withdrawing from the study at any time.

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

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IRB EXPIRATION DATE: 07/03/2019

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. INCIDENTAL FINDINGS

N/A

21. 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: MAJ Barbara Bujak
Phone: 703-927-7209
Mailing Address: 915 Greene St. Ste 536, Columbia, SC 29201

Institutional Review Board (IRB) Office
If you have any questions about your rights as a research participant or if you have concerns or complaints about the research study, please contact the IRB Office at:

Regional Health Command - Atlantic
9275 Doerr Road
Fort Belvoir, Virginia 22060-2204
usarmy.belvoir.medcom-rhc-a.mbx.irb-office@mail.mil
(706)787-8053 or (910) 907-8351

IF THERE IS ANY PORTION OF THIS DOCUMENT THAT YOU DO NOT UNDERSTAND, ASK THE INVESTIGATOR BEFORE SIGNING. YOU MAY CONSULT WITH YOUR PERSONAL PHYSICIAN OR LEGAL ADVISOR, IF YOU WISH.

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

Please initial the sentences that reflect your choices, and then sign below:

_____ I do not authorize the storage of data collected as a part of this study for future use in research studies.

_____ I authorize the storage of data collected as a part of this study for future use in research studies.

_____I DO / DO NOT consent to an audio-recording. (circle one)

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

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IRB APPROVAL DATE: 07/04/2018
IRB EXPIRATION DATE: 07/03/2019

HIPAA Authorization Form
(Patient Participants)

Principal Investigator (PI): MAJ Barbara Bujak
Corps and Service/Department: AMEDD Center and School, Arnold School of Public Health, University of South Carolina
Title of Research Project: Chronic Pain Perceptions in Military Service Members

I. Purpose of this Document

An Authorization is your signed permission to use or disclose (release) your health information. The Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule, as implemented by the Department of Defense (DoD), requires that an Authorization contain certain core elements and required statements.

NOTE TO PARTICIPANT: Please read the information below and ask questions about anything you do not understand before deciding to give permission for the use and disclosure (release) of your health information.

II. Authorization

This form is for *patient participants only*.

The following describes the purposes of this research study:

Title: Experience of chronic pain in military service members participating in an Army Intensive Outpatient Pain Program.

The study is being conducted by University of South Carolina and Army Long Term Health Education Training doctoral student to better understand the perception of chronic pain in Intensive Outpatient Program (IOP) participants. More specifically, we will be focusing our project on the experience in IOP and changes in perception and self-management of chronic pain. You are being invited to participate in this study because you are a patient participant in the IOP.

The purpose of this study is to better understand how participation in IOP affects your experience and perception of chronic pain. You will be asked questions about your participation in IOP, outcomes and perception of your chronic pain.

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

No health information from your medical record will be used for this research project. We will use the information (dates of the IOP you attend and your contact information – email and telephone number) during the time you are in the study to be able to contact you.

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

All information will be self-disclosed by you, the participant. No other health information will be used.

C. Who may receive your health information?

MAJ Barbara Bujak is the only individual in this study that will view your health information. All other individuals involved in the study will be able to view only de-identified data and will not see names of the participants in any capacity.

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

HIPAA Authorization Form
(Patient Participants)

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 use or disclosure (release) in 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 except to the extent that the MHS has already acted in reliance on your Authorization. Even if you revoke this Authorization, any person listed above who received your Authorization for purposes of the research study may still use or disclose (release) 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 contact:

MAJ Barbara Bujak
University of South Carolina
Columbia, SC 29201
E-mail: bbujak@email.sc.edu
Phone: 703-927-7209

H. Does this authorization expire?

☐ No, it does not expire

☒ Yes, it expires at end of the research study

☐ Yes, it expires on the following date or event: _____

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 deidentified information will no longer be subject to this Authorization and may be used or disclosed (released) for other purposes.
- ☐ Once your health information is shared or disclosed (released) outside of the MHS, the privacy of your health information cannot be guaranteed and it may no longer be protected by the Federal privacy laws (such as the HIPAA Privacy Rule).

Signature of Research Participant or Personal Representative:

Your signature acknowledges that:

RHC-A IRB
IRB NUMBER: DDEAMC1706

HIPAA Authorization Form
(Patient Participants)

- ☐ You authorize the MHS to use and disclose (release) 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

RHC-A IRB
IRB NUMBER: DDEAMC1706

APPENDIX C – COMPLETE PATIENT PARTICIPANT INTERVIEW GUIDE WITH DEMOGRAPHIC QUESTIONNAIRE AND FIELD NOTE

Participant Demographics

Participant ID#:_____

Date/Time/location:_____

Interviewer: _____

Age:_____

Sex:_____

Marital status:_____

Number of children:_____

Branch of military:_____

Years of Service:_____

Rank:_____

Occupation:_____

Combat deployments (total in months):_____

Time since onset of chronic pain:_____
Pain level today (0-10)_____
Motivation for attending program: _____
Pending Medical Evaluation Board: Yes No

I believe this program will help me decrease my pain: Yes No

I believe this program will help me manage my pain: Yes No

I plan on staying in the military to finish my contract Yes No

Participant – Interview Beginning of IOP (20 min)

Participant ID#:_____

Date/Time/location: _____

Interviewer: _____

1.Can you tell me the story of your chronic pain?

Probes:

How/when did it start?

What have you been told by health care providers?

How did this affect you?

2.What treatments have you received before coming to IOP?

Probes:

What specialty providers have you seen?

What testing/imaging have you had?

Who have you been referred to: PT, chiropractor, Pain management

Who have you seen on your own? Alternative medicine, self-management, google medicine

3.How did you learn about this program?

4.How do you understand your pain now?

Probes:

Think about your treatment and activity in the past.

How does the pain affect your life/work?

How you approached the various treatments?

5.What do you hope to get out of this intensive pain program?

Probes:

In what ways do you think this program will be helpful for you?

How important is it for you to make changes?

6.What are your expectations for the future after the program?

Probes:

What are your professional and/or personal goals?

What are your priorities?

Participant – Weekly follow up (10 min):

Participant ID#:_____

Date/Time/: _____

Interviewer: _____

1.How are you doing after this week?

Probes:

Are you better, worse or no change?

How is your pain?

2.What have you found to be most beneficial?

3.What was most challenging?

4.How does the program fit so far with what you're going through?

5.How have you applied what you learned in the program in your daily life?

Participant – Interview after completion of IOP (25-30 min)

Participant ID#:_____

Date/Time/location: _____

Interviewer: _____

1.Describe your experience in the treatment program?

What expectations did you have?

What motivated you to participate?

What were the barriers to participating?

2.How has your perception of pain changed?

Probes:

How does the pain you experience differ from before IOP?

How did your symptoms and level of disability change?

What about your confidence, beliefs in your own self-management?

3. What is your pain level 0-10 today?

How has it changed from before starting the program?

4.What was important that you will remember and can use in the future?

Probes:

What will you tell people that made the program effective as you think of it now?

When did you start seeing noticeable changes?

What was least helpful?

5.What is your current activity level?

Probes:

How has it changed from before the program?

6.How has your family life changed?

Probes:

Think about your relationship with your children, spouse, other family members or close friends.

7.How has your military duty/work life changed?

Probes:

Think about the requirements of your job in the military. How has the program affected your performance? Your interactions with your command and peers?

8.What are your expectations for the future after the program?

Probes:

How do you plan to manage your pain?

What did you take away from the program?

Which parts will be useful in the future?

Participant – Field Note – Interview (for pre and post interview)

Participant ID#:_____

Date/Time/location: _____

Interviewer: _____

ENVIRONMENT OF INTERVIEW (describe the setting, people present, comfort, noise, distractions, important information not caught on recording etc.)

DESCRIPTION OF THE PARTICIPANT (appearance, dress, affect, non-verbal, mannerisms, comfort/visible discomfort, pain, willingness to share etc.)

METHODOLOGICAL OBSERVATIONS (equipment problems, flow, problems with questions or tasks etc.)

ANALYTIC OBSERVATIONS (insights gained both in relation to research questions and the unexpected)

QUALITY OF INTERVIEW (general impression of trustworthiness, depth, and overall quality of data)

OTHER COMMENTS (other seemingly important insights or observations not captured above)

APPENDIX D – STAFF PARTICIPANT INTERVIEW GUIDE

Staff - Interview questions (may not ask every person all questions).

Participant ID#:_____

Date/Time/location: _____

Interviewer: _____

1. Why do you think this program is effective?
2. How does someone's chronic pain that they have had for years change after a short three-week program?
3. What kind of patients are most likely to benefit from this program?
4. What are some of the barriers to attending this program?
5. Which parts do you think patients find the most beneficial?
6. How can the program be improved?

APPENDIX E – FIELD OBSERVATION NOTE FOR PI AS PARTICIPANT-OBSERVER

Session _____(checklist used for each component of the program)

Was the session canceled? ___Yes ___No

Did the session begin on time? ___Yes ___No

Did the session end of time? ___Yes ___No

Was the lighting adequate? ___Yes ____No

What was the temperature? _____

Adequate breaks? _____ Water?_____

Was there space adequate for conducting physical training, yoga, etc?___Yes ___No

Was there adequate equipment? ___Yes ___No

How participants many in attendance? _____

Did all participants attend? ___Yes ___No

Was the instructor actively engaging with participants ___Yes ___No

How many participants fully engaged in the session (made effort to perform all activities)?

Comments:_____

How many participants did not engage in the session (consider lack of effort, lack of interest, pain, fatigue, others)?

Comments: _____

Did fatigue prevent full participation in session? ___Yes ___No

For how many participants? _____

Comments: _____

Did pain prevent full participation in session? ___Yes ___No

For how many participants? _____ Comments: _____

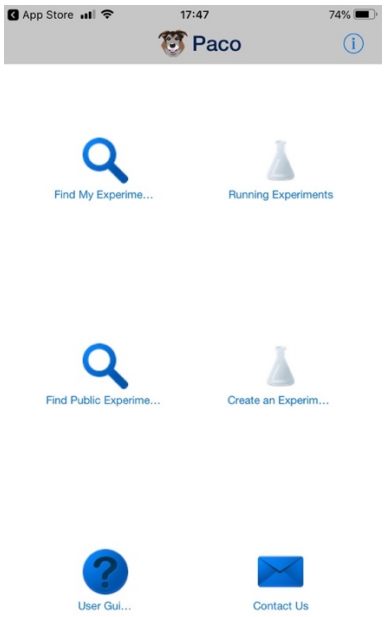
APPENDIX F – PATIENT PARTICIPANT ECOLOGICAL MOMENTARY ASSESSMENT QUESTIONS

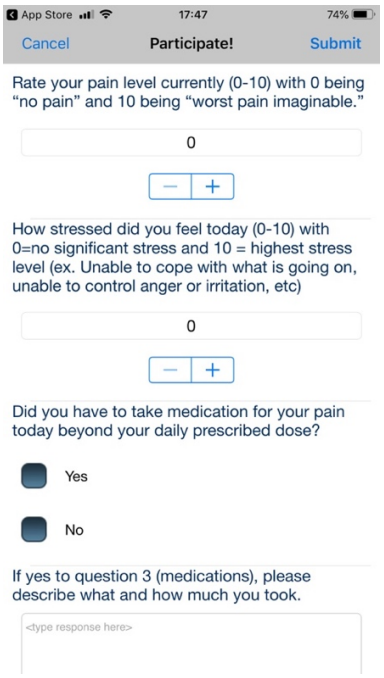
1. Rate your pain level currently (0-10) with 0 being "no pain" and 10 being "worst pain imaginable."
2. How stressed did you feel today (ex. Unable to cope with what is going on, unable to control anger or irritation, etc)

   0 = no significant stress, 10 = very high stress level

3. Did you have to take medication for your pain today beyond your daily prescribed dose?
   a. No
   b. Yes, describe what and how much you took.
4. What session(s) did you attend today?
   a. (check box of all attended) or none of the above
5. Which session(s) were most beneficial for you and your goals?
   a. List of sessions or none of the above
6. Which session(s) increased your pain today?
   a. List of sessions, none of the above
7. Which session(s) decreased your pain today?
   a. List of sessions, none of the above
8. Did you make progress toward your goals today?
   a. Yes/no
9. I received social support for my chronic pain today from health care professionals, friends, family, co-workers, and/or others.
   a. Yes/no

10. What type of social support did you receive for your chronic pain (check all that apply)?
    a. Informational support (examples: offered me suggestions about how to deal with my chronic pain, pointed out online resources to help me with my chronic pain management, etc.)
    b. Tangible support (examples: loaned me something to help me with my chronic pain management; took on a responsibility to free up time for me so I could focus on dealing with my chronic pain)
    c. Esteem support (examples: complimented me; motivated me; validated my feelings; relieved me of blame)
    d. Network support (examples: introduced me to new people who could support me in dealing with my chronic pain; pointed out others in my social network available to support me)
    e. Emotional support (examples: encouraged me; prayed for me; listened to me; showed understanding; expressed sympathy; showed physical affection)
    f. I received no social support for my chronic pain management today
11. I found the collective social support I received for my chronic pain management today to be beneficial
    a. Yes/no
12. Any additional comments about your experience today?
    a. (Free text)





End of program EMA questionnaire (SMS<1min):

1. I was satisfied with the 3-week intensive outpatient pain program

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

2. I felt that answering the daily survey questions on my smartphone was an easy task to integrate into my evening

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

3. If I participated in the pain program again, I would be willing to answer these daily survey questions again

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

APPENDIX G – QUALITATIVE STUDY CODEBOOK

- Name
- Challenges of IOP
  - challenges within individual
  - challenging components of the program
    - battle drills
    - Ruck
    - running
  - new pain during program
  - other barriers
- Chronic pain condition
  - ankle pain
  - arthritis
  - back pain
  - compression fractures
  - degenerative disc disorder
  - foot pain
  - hip pain
  - knee pain
  - leg pain
  - mechanism of injury
    - AIT training
    - breast size
    - car accident
    - Chiropractor treatment
    - combatives
    - deployment
    - hip tilt
    - hit by car
    - increased mileage running
    - moving heavy equipment
    - no injury
    - poor posture
    - pregnancy
    - running with load
    - sit ups
    - sitting job
    - sitting on a plane
    - sports
    - tight muscles
    - wear and tear
    - weightlifting
  - neck pain
  - numbness
  - onset of pain (time)
  - sciatica
  - shooting pain
  - various conditions
  - whole body hurts
  - wrist pain
- future expectations
  - Activity Plan
  - Applying IOP strategies
  - continue behavioral health
    - excited for future after program
    - fear of injury (ongoing after IOP)
    - function at work after IOP
    - future expectation for self
    - hopes that can discipline self and continue after IOP
    - lots of trial and error to figure out best plan for future
    - no specific plan for after IOP
    - teach others what I learned here
    - unsure about work duties after IOP
- Goals
  - be more functional
  - be more mindful
  - become healthier
  - check the box
  - enjoy daily life
  - fix my pain
  - get better
  - get my life back
  - go back to normal

Hobbies goals
be able to go out dancing with spouse and friends
be able to ride a bike
be able to sit through a movie
get back to hiking
get back to hunting
walk my dog
Home goals
be able to do housework
be more mobile around home
do yardwork
learn things I can do at home
perform ADLs with less pain
improve knowledge
improve nutrition
improve sleep
increase energy
lose weight
manage pain
pain not taking over my life
Physical Activity goals
be able to run
become physically fit
don't stop activity due to pain
find alternative exercises to be active again
fine tune exercise program
improve mobility
know what I can and cannot do
lift heavier objects
play with child
return to being active
return to my previous workout routine
return to playing sports
revamp workout after IOP
strengthen muscles
weightlifting
prevent need for more aggresive treatment
protect my body
Psychosocial goals
decrease kinesiophobia
feel optimistic
gain confidence in ability to self-manage
get my motivation up
improve mentally
improve mood
improve relationship with spouse
learn how to cope with pain
positively effective to my own body
spend more time with spouse
want to change mindset
reduce medication use
reduce pain
return to being a doer
share information about pain with others
Work goals
be able to deploy
be able to ruck march
be able to sit at work
finish military contract
pass PT test

professional goal
professional satisfaction
return to duty
return to work
IOP changes
challenging in a good way
function at home during IOP
functional progress in IOP
good pain
home exercise program during IOP
increased soreness
medication use during IOP
Negative or no changes
area of pain is larger
could not perform some exercises
discouraged and self-defeating
do not feel any different
knowledge does not help overcome my pain
lack of confidence in ability to self-manage

no change in functional level
no change in mindset
no change in pain perception
no specific goals for IOP
perceived worsening in IOP
sleep issues
some of these components are not helpful for me
this is not helping to fix me individually
unable to cut cord from passive treatments
not used to being so active
Positive changes
able to lift child
able to lift weights properly at the gym
able to sit longer
able to walk my dog
awareness of engaging core muscles

being more mindful
confidence in ability to do various activities
confidence in continued improvement
Confidence in self-management
decreased pain interference
decreasing fear of movement
decreasing pain
decreasing social isolation
doing better than expected
drinking more water
eating healthier
finding balance between all activities
functional improvement verbalized
good to be active again
got out what I put into it
improve communicating about my pain

improved coping with pain
improved endurance
improved physical fitness
improved planning and daily goal setting
improved posture
improved running
improving flexibility
improving knowledge
improving mentally
acceptance of pain
apologized for being mean
change in mindset
don't have to keep pushing through the pain
feeling more positive
I can do it
increased awarene

ss of pain effect on daily life and relation ships
less worry
mental break from pain
peace of mind
realization it is not a 'fix'
realization of the depth of mental component in chronic pain
reduce negativity
reducing stress and anxiety
use relaxation techniques
improving muscle strength
improving sleep

increased physical activity
learn proper techniques
learning self-management tools
less pain behaviors
less pain when active
lost weight
lower pain than expected
more energy at home
perform exercise slower with good form
spending time on hobbies
spending time with family and friends
spouse is happier with me
tested own limits to know what to do
Progress towards goals
Progression of Pain
reinforced understanding of what already knew
setting realistic goals

IOP classes
beneficial treatment in IOP
IOP acupuncture
IOP adventure therapy
IOP aquatic therapy
IOP behavioral health
IOP chiropractor
IOP circuit and advanced exercise
IOP goal setting
IOP massage
IOP meditation
IOP Pain education class
IOP pharmacy class
IOP push ups
IOP RPRT
IOP ruck marching
IOP running
IOP sleep education
IOP yoga
not beneficial treatment in IOP
Limitations
affects every point of life
barely staying above water
difficult to sit at work for long periods
difficult to sit for long periods
gained weight
gave up some exercises completely
hard to be physically active
hard to get out of bed
hard to hold child
hard to walk
hypermobility
lack of endurance
Less motivated at work
less motivated to workout
lifting anything
night pain
not enjoyable to do activities
pain interferes with family time
pain worse with activity
quitting activity because of pain
sleep problems
soreness
tight and stiff
too many problems to find appropriate modifications that don't increase pain
try to take it slow and easy
unable to clean house
unable to complete PRT
unable to concentrate
unable to cook
unable to cut grass
unable to do hobbies
unable to do simple things
unable to do sit ups
unable to hike
unable to play sports
Unable to run
unable to stand too long
unable to type at work
unable to weight lift
weakness
Mindset
advocate for self
attitude determines outcome
comparing to others
dealing with pain
happy to have an answer regarding my pain
have open mind to change
have open mind to try new things
have to work harder
high expectations for self
mission first
need to stop complaining
need to take care of self first
take mind off pain
take ownership to getting better
things still need to get done

you are the mission
motivation to attend IOP
motivated to stay in service do better
motivation while in IOP
Past Experiences
became more active when joined military
did not know what to do to help self
home exercise program
imaging
Inconsistent messages from providers
lack of consistent treatment
lost faith in military medicine
negative previous provider experience
no benefit in previous treatment
not enough treatment for their pain
previous exercise level
previous functional level at home
previous functional level at work
previous treatment helpful

Previous treatment types
chiropractor
complementary medicine
general exercise
iburofen
injections
insoles
lidocaine patches
massage
no medication
opioid medications
pain management
physical therapy
previous self-management
prior behavioral health
surgery
TENS unit
various medication
yoga
relies on medical provider
they told me
Program feedback
access to providers
actively participate in IOP
be prepared to work out
clinician expectations

criticism and recommendations for changes
daily meetings
engaged providers
feel like I exercise more
Found out about program
Hard Work
highly recommend the program
interdisciplinary care
IOP overwhelming initially
need to expand so more people know about it
perform exercises at own pace
positive program feedback
prepared for IOP
program better than expected
program expectation
program more challenging than expected
program very beneficial
successful outcome of IOP
take program seriously
wishes had known about program previously
Psychosocial

- Activity avoidance
  - easier to lay on the couch
- aggravation
- anger
- anxiety
- apprehensive
- bad mood
- catastrophizing
- deal with pain
- decision point to stay in or get out of military
- depression
- discouraged
- Don't want to do this
- either be fixed or be broken
- exhausted
- fatigue
- Fear of movement
- feel bad for self
- feel like I'm going to break down
- feel useless
- frustrated
- guilty
- highly motivated
- hopeful
- impatience
- irritability
- isolating from others
  - distancing from spouse
- lack of confidence
- moving alongside pain
- moving through stages of change
- negative
- no motivation
- overwhelmed with life
- painful mentally
- pushing through pain
- relaxation
- resentment
- scared
- self-preservation
- short tempered
- stopped worrying
- stress general
- unhappy
- worry

Relationships
- relationship with children
- relationship with family
- relationship with friends
- relationship with spouse

social support
- encouragement from others to stay positive
- family supportive
- family worried
- friend support
- group dynamics
- IOP providers supportive
- lack of trust for providers
- others don't understand my pain
- peer support in IOP
- spouse supportive
- understanding from others with chronic pain
- work relationships
  - co-workers indifferent
  - joking with coworkers
  - no interactions with co-workers
  - positive interactions co-workers
  - speak out to unit about pain
  - strong relationships with coworkers
  - supportive co-workers
  - unsupportive co-workers

Staff

Time points
- Beginning
- End
- week 1
- week 2

understanding of pain and own condition
- bio-physiological description
- difference between acute and chronic
- lack of own understanding
- pain because I was not as active

pain does not have to limit activity	IOP due to work schedule	no motivation to complete tasks
psychosocial component understanding	good work environment	pain interferes with work
understanding of chronic pain management	Hard to sit at a desk all day	poor sleep habits in job
understanding own body mechanics	high job satisfaction	putting Soldiers ahead of self
Work experience	limited duty profile	return to unit PT
continue to perform all tasks at work	low job satisfaction	secondary gain
difficult to get scheduled for	medical evaluation board	Soldier self-perception
	negative perceptions at unit	stressful work environment
		Work requires physical activity
		worried about return to work