ASSOCIATION BETWEEN HEALTH-RELATED PERCEPTIONS AND TREATMENT OUTCOMES IN AN INTERDISCIPLINARY PAIN MANAGEMENT PROGRAM

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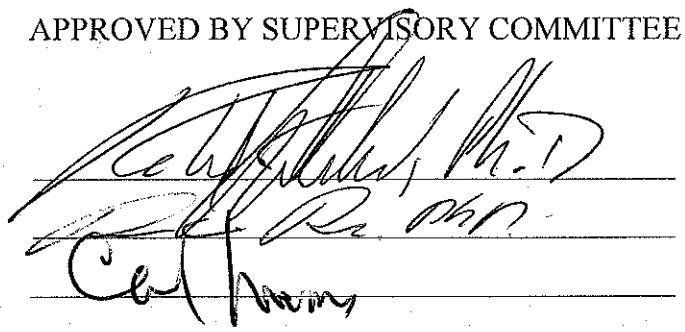

DEDICATION

I would like to thank the members of my Graduate Committee, my family, and my classmates for their continuous support.

ASSOCIATION BETWEEN HEALTH-RELATED PERCEPTIONS AND TREATMENT OUTCOMES IN AN INTERDISCIPLINARY PAIN MANAGEMENT PROGRAM

by

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THESIS

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Abstract

BACKGROUND: Adherence to treatment recommendations, specifically chronic pain treatment, is a particular area of importance in the elderly. It has been suggested that patient beliefs/perceptions play a role in treatment outcome, and the current study seeks to further explore this relationship in order to determine the extent to which health-related beliefs and perceptions effect treatment outcome.

SUBJECTS: The study consisted of a total of 103 patients, ages 20-82, who were treated at the Eugene McDermott Center for Pain Management at University of Texas Southwestern Medical Center over the past two years.

METHOD: Initial and discharge responses to Computerized Adaptive Testing (CAT) items were collected. Select measures, such as the PMQ (Pain Medication Questionnaire), BIPQ (Brief Illness Perception Questionnaire), PROMIS Global Health, Composite Pain Rating, and other PROMIS measures were analyzed via SPSS.

RESULTS: Strong correlations were found between Global Health and outcomes, specifically initial Global Health and initial outcome responses. Strong correlations were also found between initial BIPQ and initial outcome measure scores.

DISCUSSION: The results supported the hypotheses and showed that as health-related perceptions change, outcome measures can also change accordingly with the progression of treatment.

Keywords: chronic pain, interdisciplinary pain management, elderly pain management, illness perception, medication beliefs, treatment adherence, global health, PROMIS.

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CHAPTER ONE

Introduction

Chronic Pain Background

Chronic Pain in the General Population

The estimated prevalence of chronic pain globally is around 20%, and some evidence suggests that chronic pain could be considered "a public health crisis" (Kerns, Sellinger, & Goodin, 2011). Pain is estimated to affect over 100 million American adults, where some sub-populations are at a higher risk for experiencing pain than others (Institute of Medicine, 2011, p. 2). The American Productivity Audit reported, in 2003, that $61.2 billion was lost due to pain-related lost productivity time alone, not including healthcare costs or other related costs (Kerns, Sellinger, & Goodin, 2011). Currently, between $560 and $630 billion is spent annually on various aspects of chronic pain treatment, such as lost productivity time, medical expenses, and other expenses. This is only including lost productivity for workers between the ages of 25 and 64, so this estimate is likely lower than the total expense (Institute of Medicine, 2011, p. 5). In addition to significant economic costs, chronic pain also most likely has a significant impact on individuals. Since chronic pain is so widespread and has such substantial consequences, utilization of established findings to further advance research in chronic pain management and treatment is crucial.

Pain and the Elderly

The population of elderly (≥65 years of age) in the United States, as of 2011, was 41.4 million, or 13.3% of the total U.S. population, and will continue to increase (A Profile of Older Americans, 2012). Treatment for pain begins with an accurate pain assessment; an inappropriate

pain assessment can be the cause of under- or overtreatment (Cavalieri, 2007). Proper treatment for pain can vary greatly depending on the individual. Inadequate pain management can lead to detriments in several areas of functioning, including cognitive impairment, impaired ADLs, and social isolation (Cavalieri, 2007; Rastogi & Meek, 2013). The elderly are more likely than the non-elderly to have chronic pain-associated disorders (Cavalieri, 2007). In addition to pain assessment, underreporting by patients, variance in clinical exhibitions of pain, lack of age-related "standardized management guidelines for various health problems", comorbidities, and negative attitude toward healthcare practitioners all pose challenges to effective pain management (Cavalieri, 2007; Rastogi & Meek, 2013).

Chronic pain and comorbidities likely means a quite complex medication regimen, and quantifying regimen complexity, as proposed by George, Phun, Bailye, Kong, and Stewart (2004), may have a role in predicting adherence. Another part of what makes pain management even more of a challenge in elderly patients is the fact that older patients have a higher risk of adverse reactions from any type of medication, including those used for pain (Cavalieri, 2007). Thus, with each additional medication an older patient is prescribed, the risk increases even further. It has been found that older adults consume more medication than any other group in the U.S. (Marcum & Gellad, 2012).

Medical and Biopsychosocial Model of Pain

The traditional medical model provided an understanding of disease treatment, but it did not address behavioral or psychological issues (Engel, 1977). Basically, the biopsychosocial model incorporates the illness as well as the patient (Engel, 1977). Behavioral and psychological interventions are pertinent aspects of effective pain treatment, which is a significant change from

the original, purely biological treatment of pain (Kerns, Sellinger, & Goodin, 2011). Research has shown that effective pain management requires much more than simply prescribing medications. Interdisciplinary pain management programs implement the biopsychosocial model by integrating physical, cognitive, behavioral, and emotional treatment interventions (Gatchel, McGeary, McGeary, & Lippe, 2014). Beliefs, or cognitions, in relation to pain perception can "trigger additional emotional and behavioral reactions that amplify the experience of pain" (Gatchel et al., 2014). Though intervention methods have changed significantly, medications are still a crucial part of treatment, especially for chronic conditions.

Adherence and the Elderly

Medication adherence is a particularly relevant area of study in the elderly population, as adults 65 years of age and older are responsible for at least 34% of pharmacy expenses and consume more medication than any other group in the United States (Marcum & Gellad, 2012; Orwig, Brandt, & Gruber-Baldini, 2006). Numerous evaluations of medication adherence have found that around 50% of elderly adults are non-adherent to at least one of their chronic prescription medications (Marcum & Gellad, 2012). This implies that a patient could have multiple adherence rates (one for each of their medications) and may be more adherent to one medication than another, which could have an impact on the methods researchers use to assess adherence.

The ability to manage one's medication regimen, which has been "acknowledged as one of the key skills needed for successful independent living" (Elliott & Marriott, 2010) plays a major role in medication adherence; both adherence and adequate overall medication management are important in regards to one's health. Therefore, a goal of several studies is to

determine how to enhance adherence as well as medication management ability. This includes adherence to treatment in general, not solely medication adherence.

CHAPTER TWO

Review of the Literature

Adherence Factors, Assessment Instruments, and Limitations

Defining Adherence

Throughout the literature, there are various definitions for the term "adherence." Marcum and Gellad (2012) define adherence as "the extent to which a person's behavior […] corresponds with agreed recommendations from a health care provider." This definition of adherence refers to treatment recommendations in general, which could include diet, exercise, and non-traditional interventions. The proposed definition of adherence by Cramer et al. (2008) is more specific to medication, stating "the extent to which a patient acts in accordance with the prescribed interval and dose of a dosing regimen." These are only two examples of the multitude of definitions of adherence, and though they are not exactly the same, they both have the same general idea that describes behavior that is congruent with provider's recommendations. However, having the same general idea is not the same as a 'standard' definition when it comes to research. The existence of various definitions of the word makes it difficult to compare studies done by researchers who may define and measure adherence differently in their respective studies.

Along with differing definitions of adherence, researchers use different cutoff points to differentiate medication adherence from non-adherence. Gellad, Grenard, and Marcum (2011) cited a study done by Chapman et al. in 2008 that labeled participants (n=4052) as adherent if they had taken both their antihypertensive and lipid lowering medications correctly for 80% of the days studied. Topinkova, Baeyens, Michel, and Lang (2012) addressed the prospect of a

patient taking more than the prescribed amount of medication by considering a patient adherent if he or she "reliably consumes between 80-120% of the recommended medication." While over-adherence is generally not as big of an issue, it is important to note that it does exist and that overdosing can have serious consequences. This is especially true in a chronic pain population where patients may be taking opioids or other controlled substances and misuse can be fatal.

Not only are there varying definitions of medication adherence, there are also a wide variety of assessment tools and measurements used to describe adherence. As far as actually assessing adherence, there is a lack of versatility in the majority of the tools, as none are clinically useful across all populations. Elliott and Marriott's (2010) review of instruments found ambiguity among the assessment tools as far as which skills were included on the instrument, as well as how to assess those particular skills. For example, 96% of the instruments reviewed (42 of 44) assessed the ability of the participant to open their medication package, but only 43% of the instruments assessed motivation and insight (e.g. belief that medication is important and motivation to self-administer medications) (Elliott & Marriott, 2010).

Identified Adherence Factors

The vast number of factors associated with medication adherence makes measurement as well as analysis a very complex process. Simply identifying all possible factors is a task in itself, but is pertinent for recognizing patients who may be at-risk for non-adherence. Gellad et al. (2011) broke adherence down into two types. Primary non-adherence (non-fulfillment) takes place when the patient fails to initiate therapy prescribed by their provider, and non-persistence refers to when the patient starts taking their medication but stops taking it without consulting

with their healthcare provider (Gellad et al., 2011). Marcum and Gellad (2012) later added a third category of adherence, non-conforming, which refers to various techniques of taking medications incorrectly (e.g., incorrect doses, incorrect timing, or skipping dose(s) all together). Though the types of non-adherence will have differing factors associated with them, being able to identify the type of non-adherence is helpful and likely a step in the right direction.

There are some discrepancies across the literature on whether or not certain factors are significantly associated with adherence (positively or negatively) or not significantly associated at all. For example, out of 9 articles reviewed by Marcum and Gellad (2012), six found a negative association between poly-pharmacy (number of medications) and adherence, one found a positive association, and two found no significant association between poly-pharmacy and adherence. There is no single independent variable that can predict adherence on its' own; the multitude of variables associated with adherence come in the form of barriers or hindrances as well as facilitators or enablers.

Barriers. Murray et al. (2004) listed several reasons for non-adherence, including cognitive impairment or forgetfulness, lack of understanding directions, inability to self-administer, lack of communication, attitudes and beliefs, and lack of documentation of adverse drug events (ADEs). Chen, Wu, Yen, and Chen, Z. (2007) conducted an adherence study with elderly patients diagnosed with cardiovascular disease (n=19) and identified major inhibiting factors as memory deficit, complex medication regimen, poor physical condition, and "other competitive needs in life". The study also identified medication cost as being associated with adherence (Chen et al., 2007), which was not identified in the study by Murray et al. (2004).

Elliott and Marriott (2010), similarly to Chen et al. (2007), discussed physical condition as a barrier to adherence. Decreased dexterity may render a patient unable to take their medications or may require them to depend on assistance from others. Both Chen et al. (2007) and Murray et al. (2004), along with other studies, recognize cognitive impairment (forgetfulness, memory deficit, sensory impairment, etc.) as an inhibiting factor of medication adherence. Cognitive impairment has been linked to non-adherence and medication errors in the elderly and affects one in six elderly adults (Elliott & Marriott, 2010). Medication errors made by patients account for over 20% of "preventable adverse drug events" in the elderly population (Elliott & Marriott, 2010). Decreased physical and/or decreased cognitive functioning are both important factors for physicians to be aware of when interacting with patients and formulating medication regimens.

Gellad et al. (2011) identified three groups of factors: patient-related, drug-related, and other. Identified within these groups and added to the list of barriers to medication adherence were higher number of drugs, higher co-morbidities, occurrence of adverse drug events, poor health literacy, and logistic barriers (Gellad et al., 2011). Logistic barriers include lack of transportation and lack of insurance coverage for a medication (Gellad et al., 2011). Poor health literacy is associated with health outcomes and has been identified as a barrier to adherence in some studies, yet not found to have a significant effect in others; however, Baker, Parker, Williams, and Clark (1998) indicated that patients with poor health literacy were two times more likely to be hospitalized. A more recent study done in 2005 by Osterberg and Blaschke (as cited in Julius, Novitsky, & Dubin, 2009) stated that non-adherence is the cause of one-third to two-thirds of all hospitalizations related to medication. The link between health literacy and

adherence is an example of one of the many relationships that needs to be studied more in depth in order to gain a better understanding of adherence and treatment efficacy.

In addition to the patient related, drug related, and other factors groups, a meta-analysis of 33 randomized control trials by Topinkova et al. (2012) identified the importance of clearly classifying organizational, structural, and operational barriers to adherence. These include addressing institutional challenges and coordinating cooperation at various levels of care (Topinkova et al., 2012). This is an important set of barriers because, unlike other studies, it recognizes barriers other than those directly related to the patient. Most of the previously mentioned barriers focus on issues on the patient's end; but, if institutional barriers are not taken care of or addressed beforehand, the patient may not receive the proper care and will probably be less likely to adhere to their medication. These organizational barriers should not be an issue in true interdisciplinary programs, because the treatment team should ideally be communicating with each other frequently. In spite of the several barriers that may deter a patient from adherence, there are also several factors that act as facilitators and can be used to help predict adherence.

Facilitators. Patients' perception of illness, severity outcome, and their response to their prescriptions constitute the "most proximal result of medication adherence" (Murray et al., 2004). Similarly, according to Ekman et al. (2006), patient's attitudes, beliefs, and perceptions of their medications are the most robust forecasters of non-adherence. This means that in order for a patient to actually adhere to their medications, in addition to possessing positive "predisposing characteristics", they must also perceive a *need* to adhere (Murray et al., 2004). A positive, engaging relationship between the patient and physician (as well as the presence of

other supporting factors) may be help facilitate adherence, but ultimately the patient's perceptions and beliefs are key predictors of their adherence (Phillips, Leventhal, E., & Leventhal, H., 2011). Patient 'belief' is a broad category: it includes beliefs towards taking medications, one's belief in their physician, and self-efficacy, among others. Self-efficacy with regard to medication is defined as "one's beliefs in one's ability to successfully execute a behavior [taking medication] required to produce a certain outcome" (Cameron et al., 2010).

Another belief that facilitates adherence is that the recommended medication therapy is both effective and necessary for health improvement (Elliott & Marriott, 2010). Several studies have revealed a "direct relationship between adherence behavior and patients' understanding of the treatment regimen and beliefs about medications" (Chen et al., 2007). Whether or not a patient believes their medication can help them may have an effect on the patient's experience of "the medication's impact on functional ability, symptoms, and well-being" (Ekman et al., 2006). Other facilitators of medication adherence include enabling resources, such as reliable transportation, shorter distance from health care services, adequate insurance, adequate income, cultural factors, and support from others/ supervision (Elliott & Marriott, 2010; Murray et al., 2004). Using special reminders to help one remember to take medications, individualized medication regimens, and simplified (as much as possible) medication regimens may promote adherence by making the process of taking medications less complex (Chen et al., 2007).

As briefly previously mentioned, a good patient-healthcare provider relationship can also affect adherence behavior (Murray et al., 2004). Perceived partnership, one of four themes defined in a study by Chen et al. (2007), is labeled a facilitator of adherence when the patient perceives their provider as a keen listener, sincere, warm, and responsive to patient questions.

Perceived reality is another theme that can promote adherence if patients accurately perceive and understand the purpose of their medications (Chen et al., 2007). Patients who accept the reality that they might have to take medications chronically are more likely to stick to the regimen versus those who just stop their medications if they are not having symptoms (Chen et al., 2007).

Perceived effectiveness may be somewhat of a precursor to perceived reality; patients who perceive their medications as appropriate and effective are more likely to recognize the reality involving prolonged medication use (Chen et al., 2007). Interpersonal influences, which consists of "information sharing among relatives, friends, and other resources," can increase a patient's perceived effectiveness, partnership, and reality if the information obtained is in favor of taking medication properly (Chen et al., 2007). Positive perceptions of effectiveness, partnership, and reality are all necessary for maintaining adherence. In addition, Phatak and Thomas (2006) identified "beliefs about medications, knowledge about disorders, perceived short-term social benefits, perceived personal benefits of their decisions, and perceived impact of their decisions on day-to-day living" as modifiable factors associated with adherence. Patients' medication beliefs may be formed based on previous adverse effects, long-term risks, and the degree to which medications affect daily life, as well as other events or experiences (Phatak and Thomas, 2006).

A patient's beliefs and perceptions, motivation, and attitudes are clearly important factors in determining adherence, yet more information is still needed regarding these relationships and direct impact on adherence and treatment outcome, especially for the elderly and patients with chronic conditions. Many of the available instruments focus more on ability or behavior and not as much on these internal cognitive or perceptual factors.

Assessment Instruments

Though there is no brief assessment tool available that can be used routinely in primary care to "identify individuals with medication management problems or to guide the type and amount of support required to manage medications," there are several instruments that have potential and need to be compared in future studies (Farris & Phillips, 2008). The instruments that have significant findings and merit further research, according to Farris and Phillips (2008), include the Drug Regimen Unassisted Grading Scale (DRUGS), the Medication Management Instrument for Deficiencies in the Elderly (MedMaIDE), Beckman's tasks, and the Medication Management Ability Assessment (MMAA). Other instruments of importance include the Medication Adherence Questionnaire (MAQ), the Beliefs about Medicines Questionnaire (BMQ), the Morisky Medication Adherence Scale (MMAS), the Pain Medication Questionnaire (PMQ), and the Brief Illness Perception Questionnaire (BIPQ).

Drug Regimen Unassisted Grading Scale. The Drug Regimen Unassisted Grading Scale (DRUGS) is a cross-sectional study in two Boston retirement centers of patients ≥70 years old (n=59) (Edelberg & Shallenberger, 1999). This was the first study to examine the relationship between medication management and functional status (Edelberg & Shallenberger, 1999). The extent of the effect of functional status on medication management and adherence is still under deliberation today. The DRUGS tool measures identification (ability to identify the correct medication), access (ability to open containers), dosage (ability to dispense the correct dose), and timing (demonstrating when to take medications), and found an association between the DRUGS tool score and cognitive functioning level (Mini-Mental Status Examination score) (Edelberg & Shallenberger, 1999).

As cited in Farris and Phillips (2008), Hutchison et al. completed a study comparing the Medication Management Ability Assessment (MMAA) to the DRUGS. The study consisted of 51 participants who were given the MMAA, DRUGS, and MMSE (Farris & Phillips, 2008). The results indicated that self-reported adherence showed no correlation with the MMAA or DRUGS scores; medication adherence was, however, correlated with the MMSE score (Farris & Phillips, 2008). The DRUGS score was found to be inversely related to age, but there was no significant association found between gender, number of medications or frequency of dosage, or education level (Edelberg & Shallenberger, 1999). Though this tool does not appear to correspond to simple self-reports of adherence, it may be able to identify older patients at an early stage of cognitive decline, which is when an intervention would likely be the most effective (Edelberg & Shallenberger, 1999). Identifying cognitive decline and implementing an intervention is likely to ultimately have a positive impact on adherence.

Medication Management Instrument for Deficiencies in the Elderly. Similar to the DRUGS tool, the Medication Management Instrument for Deficiencies in the Elderly (MedMaIDE) also assesses for cognition and adherence in patients. The three domains measured by the MedMaIDE are: knowledge of medications, procurement, and how to take medications (Orwig et al., 2006). Procurement refers to whether or not one is aware of how to actually obtain their medication (e.g., how to refill/ tell if refills are available, who to contact to get more medication, etc.). The MedMaIDE has a test-retest reliability of 0.93 and an inter-rater reliability of 0.74; the instrument seems to be valid in identifying whether an elderly patient has any deficiencies in medication management ability, specifically deficits with regard to medication knowledge, administration, and access to medications (Orwig et al., 2006). As in the

administration of the DRUGS tool, participants given the MedMaIDE were also given the MMSE and the ADL Index to test cognitive functioning (Orwig et al., 2006). The participants in this study are considered 'highly functioning', and yet 70% of the participants (n=50) were found to have one or more medication management deficiencies based on their MedMaIDE results (Orwig et al., 2006). This study stresses the importance of not only assessing compliance, but detecting the causes of noncompliance in order to determine if a patient is in need of or could benefit from an intervention. This study also highlights the need to pay special attention to the presence of cognitive decline, as well as the need for more research on the extent of its effect on treatment outcomes.

Beckman's Medication Management Tasks. Beckman's Medication Management Tasks do not assess adherence directly, but do test cognition, other aspects that affect adherence, is brief, and assesses literacy and medication management ability (as self-reported by the participants) (Farris & Phillips, 2008). Beckman, Parker, and Thorslund's (2005) assessment of medication management used five questions/actions that tested hand functioning such as in the ability to open medication bottles, ability to read prescription labels, and medication competence, including ability to perform calculations. Though the tasks assessed by Beckman et al. differ from those assessed by the MedMaIDE, the percentage of participants who showed at least one deficit is about the same. Out of 492 total participants over the age of 77 in Sweden, Beckman et al. (2005) found that about two-thirds could not 'pass' at least one of the five performance tasks assessed. The high percentage of elderly patients with at least one deficit is something providers should be aware of and take into consideration when treating patients. Of those who did not pass all of the tests, interview question responses revealed that 214 participants thought of themselves

as able to independently take their medications (Beckman et al., 2005). This indicates a discrepancy between self-reported ability and performance based ability. Discrepancy between patient report and outcome in general should be further explored, especially in elderly patients. Self-report characteristics also likely vary widely across varying clinical populations.

Medication Adherence Questionnaire. The Medication Adherence Questionnaire (MAQ) created by Morisky et al. (1986) is a four-question scale that was given to a total of 400 participants from two outpatient clinics who were receiving treatment for high blood pressure. The sensitivity and specificity of the scale were found to be 0.81 and 0.44, respectively, and the internal consistency was found to be 0.61. This scale can be used as a diagnostic tool to assess patient level of understanding, adherence behavior, and problems related to adherence. Once these aspects are assessed by the scale, the physicians will have a better idea of the status of their patients in regards to their medication-taking cognizance and behavior. This brief questionnaire assesses adherence behavior and patients' level of understanding (Morisky et al., 1986), which are both still key factors and relevant areas of concern for physicians.

Morisky and colleagues created another scale, The 8-Item Medication Adherence Scale, based off of the MAQ that assessed "circumstances surrounding adherence behavior" (Morisky et al., 2008). There is a significant correlation between the 4-item MAQ and the 8-item scale, and the 8-item scale added measures of satisfaction with care, social support, and coping behavior (Pearson correlation, 0.64; $P<0.05$) (Morisky et al., 2008). Both of Morisky's scales were originally developed for outpatients being treated for high blood pressure, but the items can be easily modified to include patients' complete medication regimen.

Phatak and Thomas (2006) found that patients' medication beliefs, such as necessity, concerns, overuse, and harm, accounted for 22.4% of variation in nonadherence to chronic medications. The Beliefs about Medicines Questionnaire (BMQ) and the Morisky Medication Adherence Scale (MMAS) were used to assess medication beliefs and medication nonadherence, respectively (Phatak and Thomas, 2006). Though number of medications showed a significant positive association with nonadherence, this study found that the number of medications a patient was taking did not have a significant effect on the relationship between medication beliefs and nonadherence.

Brief Illness Perception Questionnaire. The Brief Illness Perception Questionnaire (BIPQ) is a self-report instrument designed to measure cognitive and emotional representations of illness. Researchers have grouped cognitive depictions of illness into five dimensions: identity, consequences, cause, timeline, and cure or control (Broadbent, Petrie, Main, & Weinman, 2006). Emotional representations of illness include expression of fear, distress, anger, and other negative reactions (Broadbent et al., 2006). One advantage of the BIPQ is that the word "illness" in each of the items could potentially be substituted for a specific condition depending on the population of interest. Another advantage is the brevity of the questionnaire, making it relatively easy and quick for the elderly to complete. The correct treatment plan has the ability to change illness perceptions over time, thus hopefully improving outcomes. The BIPQ allows patients to define their symptoms and the degree they feel those symptoms affect their lifestyle. The last item on the BIPQ asks patients to name what they feel is the cause of their illness. The perceived cause of illness likely affects how patients perceive symptoms. Validity and reliability of the BIPQ has been tested and found to be satisfactory, though only for

the assessment as a whole, not at the item level (Lochting, Garratt, Storheim, Werner, & Grotle, 2013).

Pain Medication Questionnaire. The Pain Medication Questionnaire (PMQ) was designed to assess for potential prescription opioid misuse, specifically in the chronic pain population (Adams, et al., 2004). The PMQ specifically measures beliefs associated with pain medications, such as belief that enough pain medication is being prescribed, belief in the amount of time spent discussing pain medication with physicians, belief of whether or not the prescribed dosage of pain medication is sufficient, belief in the necessity of pain medication, and even the belief in the extent of dependency on pain medication (Adams, et al., 2004). Though the PMQ items specifically inquire about pain medications (including medication use, medication beliefs, and medication side effects), Adams et al. (2004) found associations between high PMQ scores and "history of substance abuse, higher levels of psychosocial distress, and poorer functioning." Similarly, the BIPQ was also found to be associated with "poorer physical, social, and psychological functioning" (Lochting et al., 2013). Aberrant pain medication beliefs and poor illness perceptions likely pose as a challenge to treatment planning, but identifying these beliefs early in the treatment process is crucial.

Summary. The instruments described are only a small portion of the available tools for assessing medication management capacity, functional status, performance-based tasks, self-reported measurements (such as medication beliefs, illness perceptions, and emotional responses to these beliefs and perceptions), and several other factors that have an impact on adherence and treatment outcome. As previously mentioned, there is no one instrument or factor that is consistently predictive of adherence. Although there is vast research on the topic and great

improvements have been made, there are still several issues and confining factors that need to be resolved for future studies in order to ensure that treatment is individualized and as effective as possible.

Limitations of the Literature

The number of instruments available, variety of methods used, and ambiguity among researchers (and instruments) on defining factors make it difficult to compare results of studies. For example, a systematic review of nine studies found one claiming that taking more than three medications resulted in lower odds of non-adherence, another study claimed the same result for five or more medications, and yet other studies have shown that the number of medications alone is not associated with adherence (Gellad et al., 2011). Such a large number of factors must be taken into account when assessing adherence that researchers are required to analyze multiple independent variables at once. This presents a problem in the sense that one single variable's relationship with adherence is not likely well established, such as indicated in Marcum and Gellad (2012) with the relationship between poly-pharmacy and adherence.

Another issue established in the reviewed literature is that of time. The amount of time it takes to complete an assessment, survey, or interview has an effect on performance, especially that of older adults and those with decreased cognitive endurance. Too lengthy of a test can result in fatigue and skewed results. An appropriate assessment must be brief, yet must be inclusive of various measurements in order to be effective and produce desired results. When developing a performance based assessment, researchers must determine which skills they want to include. Even if two instruments include the same skills, researchers may choose to measure the same skill in different ways. There is also the issue of how to obtain data, whether it is done

by self-report or performance-based assessments, or even conducting an interview versus having participants write or type their responses to a survey.

The reviewed literature displays a variety of sample sizes, but all seemed to be very specific in their selection criteria. Even studies with a large sample size were very specific, such as only including women (Carlson et al., 2005), only high-functioning elderly adults (Edelberg & Shallenberger, 1999), or only including participants with a specific condition such as congestive heart failure (Murray et al., 2004). Specificity in inclusion criteria is important because having a group with similar characteristics can mean less confounding variables to worry about as far as analysis of results is concerned; however, small or over-specific samples are not very likely to be representative of the population. Assessment tools geared toward a particular population or patients in a particular setting (nursing home, hospital, etc.) may work well for their projected audience, but are hard to put into use elsewhere or with dissimilar participants.

Given the fact that chronic pain is so widespread, as well as the assumption that individuals experiencing chronic pain likely endure various comorbidities along with it, a sample of patients from an interdisciplinary program should be diverse in their conditions and health status. Though accurately measuring adherence has proven to be quite difficult, measuring treatment outcomes is more straightforward. Treatment outcomes, and especially the extent to which patient beliefs affect treatment outcomes, can be an indication of the likelihood of a patient to adhere to treatment as a whole, which includes medication adherence.

CHAPTER THREE

Method

Setting

Participants of the study were selected from the Eugene McDermott Center for Pain Management. The pain management clinic includes various chronic pain treatment modalities, both interventional and non-interventional, such as cognitive behavioral therapy, group therapy, individual therapy, physical therapy, and diagnostic services. Patients were initially evaluated at the clinic in order to determine the most beneficial treatment plan.

Participants

Participants included patients who were treated at the Eugene McDermott Center for Pain Management between August 2012 and August 2014. Patients treated at the pain clinic are 18 years of age or older and are fluent in English. Anyone who was not able to use a laptop or was unwilling to sign the consent paperwork to participate in the study was not included. Patients seen at the clinic who did not complete baseline assessments were not included in the study. Patients who completed only the baseline assessment were also not included; all participants of the study completed baseline and midpoint and/or discharge assessments. For some participants (n =18) the last recorded observations were carried forward to the discharge time point.

Measures

PMQ. The Pain Medication Questionnaire is a 26-item self-reported measurement that assesses for the risk of prescription opioid misuse. Each item is presented as a 5-point Likert scale, ranging from zero to four points, with the exception of the last item. The last item {“How many painful conditions (injured body parts or illnesses) do you have?”} is scored on a one to

five point scale. Items PMQ.003, PMQ.004, PMQ.007, and PMQ.010 are scored in the reverse direction, but this is already accounted for in Assessment Center. Though the current study is focused mainly on specific beliefs about medications rather than potential medication misuse, the PMQ was analyzed as it includes items assessing beliefs regarding treatment. Approximate cutoffs for "high," "medium," and "low" scores on the PMQ are ≥30.0, 20.6 to 30.0, and ≤20.5, respectively, as defined by Holmes et al. (2006). A total PMQ score of ≥25 is indicative of opioid misuse, while a score of ≥30 suggests that the patient should be monitored constantly during treatment (Dowling, Gatchel, Adams, Stowell, & Bernstein, 2007).

BIPQ. The Brief Illness Perception Questionnaire is a 9-item self-report scale designed by Broadbent, Petrie, Main, and Weinman (2006) to measure cognitive and emotional dimensions of illness. The five dimensions of cognitive representation of illness are: identity, consequences, cause, timeline, and cure or control. Emotional representation consists of fear, distress, anger, or other negative reactions (Broadbent et al., 2006). Eight of the items' response choices consist of a zero to ten rating scale, where items 3, 4, and 7 require scoring in the reverse direction. The current study utilized responses to these eight items only, both at baseline and discharge time points. The last item is open-ended and was not included in the total BIPQ score. The higher the BIPQ score, the higher the perceived pain interference with daily life, higher perceived severity of symptoms, and more threating perception of illness (Broadbent et al., 2006; Lochting et al., 2013).

PROMIS Global Health. The PROMIS (Patient Reported Outcomes Measurement Information System) Global Health assessment is a measure of emotional distress and negative affect. This scale has ten items where response options are presented as a five-point Likert scale,

with the exception of Global07, which is a 1-10 scale of average pain rating. For scoring purposes, items 7, 8 and 10 are scored in the reverse direction. A high score on the global health instrument means a healthy or positive overall view of health. Items on this scale measure quality of life, both physical and mental health, social satisfaction, ability to perform physical activities, fatigue, and frequency of emotional problems (Hays, Bjorner, Revicki, Spritzer, & Cella, 2009).

Outcomes. The treatment outcomes include the change from baseline to discharge in total T-score of each PROMIS measure (besides PROMIS Global Health) and the change in average pain rating. Change in average pain, which is rated on a scale of 0 to 10, with 10 representing "worst pain possible," was measured at both baseline and discharge and considered an outcome variable.

PROMIS measures assess patient-reported health status, and employ the use of item response theory (IRT) and computerized adaptive testing (CAT) (Khanna et al., 2011). The goal of the PROMIS items is to measure "unidimensional constructs of health-related quality of life (HRQOL)" (Reeve et al., 2007). The measures included in this study are: Anger, Anxiety, Depression, Fatigue, Pain Behavior, Pain Interference, Physical Function, Sleep Disturbance, Sleep-Related Impairment, Social Satisfaction DSA, and Social Satisfaction Role. For the majority of the PROMIS measures, a high score indicates issues in the specified area. However, high scores on PROMIS Physical Function ("PhysFunction"), Social Satisfaction DSA ("SocialSatDSA"), and Social Satisfaction Role ("SocialSatRole") are actually desired.

PROMIS Anger, Anxiety, and Depression are all measures of emotional distress and negative affect, according to the Assessment Center website. Responses consist of a 5-point

Likert scale ranging from 1=”Never” to 5=”Always.” Fatigue, Pain Interference, and Sleep Disturbance ask patients to base their answer off of the past 7 days and are measured on a 5-point Likert scale ranging from 1=”Very Much” to 5=”Not at All.” Pain Behavior, Sleep-Related Impairment, Social Satisfaction DSA, and Social Satisfaction Role are also based on the patients’ experiences over the past 7 days. Pain Behavior is measured on a 6-point Likert scale ranging from 1=”No Pain” to 6=”Always,” Sleep-Related Impairment is measured on a 5-point scale from 1=”Never” to 5=”Always,” and both Social Satisfaction measure responses consist of a 5-point Likert scale from 1=”Not at All” to 5=”Very Much.” Physical function responses range from 1=”Cannot Do” to 5=”Not at All.” Examples of topics included in these measures are: guilt, irritation, panic, worry, fear, tiredness, lack of energy, helplessness, unhappiness, actions while performing a task, satisfaction with sleep, sleep habits, satisfaction with family relationships and social activities (Assessment Center website).

Procedure

The current study involved both baseline and discharge data. Patients seen for evaluation at the pain clinic completed an Informed Consent form and a HIPAA release form, and all were briefed on the purpose of the larger study. The data was collected electronically through Assessment Center from August 2012 to August 2014. The participants all completed surveys with various measures that assessed illness perception, potential for opioid abuse, and global health, for example.

The Brief Illness Perception Questionnaire (BIPQ) was given both pre and post treatment and was analyzed in this study, along with the Pain Medication Questionnaire (PMQ) and PROMIS Global Health. Composite Pain Rating and other PROMIS measures were also

administered in Assessment Center and were utilized in the current study as treatment outcome variables. A database including the above mentioned variables was created by downloading participant data from Assessment Center, and total scores for appropriate measures were also calculated. The change in total score was calculated by subtracting discharge scores from their respective baseline scores. Appropriate items were reverse scored before calculating total scores. For participants who did not answer all questions on a measure of interest (BIPQ: n =12; PMQ: n =7), an average score was calculated based on the items for which they did not provide a response, and then the average was used to fill in the questions the participant skipped in order to add up a total score. For participants with data for baseline and midpoint data only (n =18), the midpoint responses were carried forward and analyzed as though they were discharge responses. Statistical analysis was then performed in order to test the hypotheses.

Statistics

Statistical analysis was run in SPSS (Statistical Package for the Social Sciences). A Pearson correlation, which is a measure of statistical covariation between two variables, was performed to examine the relationship between illness perception and medication beliefs. A Pearson correlation was also run in order to determine the correlation between view of health and treatment outcomes, as well as illness perception and treatment outcomes. Strength of correlation coefficients was determined using the cutoff points defined by Hemphill (2003), where r <.20 = "small," .2< r <.3 = "medium," and r >.4 = "large" correlations.

A Repeated Measures Analysis of Covariance (ANCOVA), which compares means across variables, was conducted to evaluate the effect of initial scores on the change in scores over time for each variable.

Aim

The aim of the current study was to explore the impact of medication beliefs, perception of illness, and view of global health on treatment outcomes. The statistical analysis of the relationship between medication beliefs, perception of illness, global health, and treatment outcome measured the extent of the effect that health-related perceptions and beliefs have on treatment.

Hypotheses

Hypothesis 1: It is hypothesized that patient's medication beliefs are correlated with illness perception. People who score lower on the Pain Medication Questionnaire (PMQ) should also, hypothetically, score lower on the Brief Illness Perception Questionnaire (BIPQ) and vice versa. It is hypothesized that people who have a more negative, severe perception of their respective illnesses will score higher on the PMQ, meaning that they may be at higher risk for opioid misuse. Similarly, it is hypothesized a patient who is at a lower risk for opioid misuse would be likely to have a more positive outlook on his/her illness as measured by the BIPQ.

Hypothesis 2: It is hypothesized that participants' view of health and illness perception are correlated with treatment outcome. Specifically, participants who show a positive change in BIPQ score and view of health rating from baseline to discharge will perceive a greater decrease in pain level (and greater change in the outcome measures overall) than those whose BIPQ and view of health stay the same or decrease from baseline to discharge.

CHAPTER FOUR

Results

Demographic Data

Gender, race, and ethnicity. This study consisted of 103 participants. Approximately 74% of them were female (*n* =76), and 26% were male (*n* =27), as seen in Table 1. The majority of participants identified their race as White (*n* = 56), about 10% identified as African American (*n* =10), and there were very few Native Hawaiian/ Pacific Islanders and Hispanics (*n* =2 and *n* =3, respectively). The other major group, as shown in Table 2, consisted of those who did not provide an answer (*n* =32). Nearly 60% of the participants identified their ethnicity as Not Hispanic/Latino (*n* =60). The study included 8 Hispanic/Latino participants and 35 who did not provide an answer, as seen in Table 3.

Age. The ages of the participants included in the study ranged from 20 to 82 years old, with an average age of 54.03 years old (*SD* =14.06) (Table 4). Over one-third (*n* =39) of the participants were 60 years of age or older, and approximately a quarter (*n* =23) of these participants were age 64 and above. There was no significant correlation between age and change in outcome scores (Table 6), however, there was a slight but significant negative correlation between age and initial PROMIS Depression T-scores (*r* =-.21, *p* =0.35), as shown in Table 5. There appeared to be no significant correlation between age and initial pain rating.

There was also a small but significant negative correlation between age and initial BIPQ, initial PMQ, and initial Global Health scores (*r* =-.20, *p* =.048; *r* =-.22, *p* =.04; and *r* =.22, *p* =.044, respectively) (Table 7). There appeared to be no significant correlation between age and change in BIPQ, PMQ, or Global Health.

Relationship Between Medication Beliefs, Illness Perception, and Global Health

A Pearson correlation was run to determine the relationship between an individual's medication beliefs (Chng_PMQ) and illness perception (Chng_BIPQ). The variables "Chng_PMQ" and "Chng_BIPQ" represented the change in the total score of each measure for each participant from baseline testing to discharge testing. A Pearson correlation was also run to examine the relationship between the change in both of these measures with global health (Chng_Global). Then, to provide further insight, the correlation between the initial responses on these three measures was also interpreted. The baseline and discharge score frequencies for these measures are shown in Tables 8 and 9. Baseline and discharge outcome frequencies can be found in Tables 10 and 11.

Change in BIPQ, PMQ, and global health. The results of the analysis, as seen in Table 12, showed a positive correlation between "Chng_BIPQ" and "Chng_PMQ" that was moderate and significant (r =.28, p =.03). Specifically, the total score for medication beliefs decreases as the total score for illness perception decreases, but not at the same rate. Medication beliefs and illness perception both appeared to be strongly and significantly correlated with global health status (Chng_Global) (r =-.47, p <.001 and r =-.54, p <.001, respectively). The global health measure includes overall quality of life rather than focusing specifically on illness like the BIPQ, yet it is still a measure of patient's health-related perceptions. Therefore, global health may be a better indicator of treatment outcome than illness perception alone.

Initial BIPQ, PMQ, and global health. As seen in Table 13, a very similar significant relationship was found between initial illness perception (BIPQ_Total) and initial medication beliefs (PMQ_Total) scores (r =.27, p =.01). Initial medication beliefs and illness perception

were found to be significantly correlated with initial global health (Total_Global) scores (r =-.40, p <.001 and r =-.57, p <.001, respectively). These correlations are also similar to those found between the changes in measures from baseline to discharge.

Relationship Between Global Health, Illness Perception, and Outcomes

A Pearson correlation was performed to determine the relationship between change in global health (Chng_Global), change in illness perception (Chng_BIPQ), and change in outcome (PROMIS measures). Though not a PROMIS measure, the change in average pain rating (Chng_AVGPain) was included as an outcome of the program. All of the variables were calculated by subtracting discharge scores from their respective baseline scores to determine the amount of change in each variable. A Pearson correlation was also performed to define the relationship between initial global health (Total_Global), initial illness perception (BIPQ_Total), and change in outcome (PROMIS measures). Global health and BIPQ were analyzed separately with all of the PROMIS measures included in Assessment Center. Finally, initial BIPQ and initial global health were separately correlated with initial outcome measure responses.

Correlation between global health and outcomes.

Change in global health and change in outcomes. The results indicated that 10 of the 12 correlations were statistically significant, and all except for one of these (Chng_Anger) (r =-.27, p =.02) were greater than 0.35 (Table 15). The results of the correlation between change in global health scores and change in outcome measures showed a large correlation between global health (Chng_Global) and Social Satisfaction Role (Chng_SocialSatRole) (r =.55, p <.001), Pain Interference (Chng_PainInt) (r =-.65, p <.001), Depression (Chng_Dep) (r =-.55, p <.001), Anxiety (Chng_Anx) (r =-.42, p <.001), Fatigue (Chng_Fatigue) (r =-.46, p <.001), Pain

Behavior (Chng_PainBehavior) (r =-.36, p <.001), Social Satisfaction DSA (Chng_SocialSatDSA) (r =.46, p <.001), and Average Pain rating (Chng_AvgPain) (r =-.48, p <.001). The results indicated a moderate correlation between "Chng_Global" and Anger (Chng_Anger) (r =-.27, p =.02). The two outcomes that did not appear to have a significant correlation with global health assessment were Sleep Disturbance (Chng_SleepDisturbance) and Sleep-Related Impairment (Chng_SlpRltdImp). After Bonferroni correction, change in global health was no longer significantly correlated with change in anger.

Initial global health and change in outcomes. An analysis of correlation between baseline global health ("Total_Global") and change in treatment outcomes revealed a moderate and significant relationship between "Total_Global" and change in average pain (r =-.29, p =.007), pain interference (r =-.38, p <.001), anger (r =-.30, p =.005), anxiety (r =-.34, p =.001), depression (r =-.24, p =.024), and social satisfaction DSA (r =.23, p =.03) (See Table 14). Though these results were statistically significant, the correlation strength for the above mentioned outcome measures and baseline global health scores was less than the strength of the relationship between change in global health and change in treatment outcomes. After a Bonferroni correction, initial global health score was no longer found to be significantly correlated with change in average pain rating, change in anger, change in depression, or change in social satisfaction DSA.

Initial global health and initial outcome measures. To provide more insight into the correlation between global health and the outcome measures, a correlation was also run between initial global ("Total_Global") and initial outcome measure responses. All initial outcome measure responses displayed a significant positive correlation with initial global health scores, as

seen in Table 16. Initial PROMIS Sleep Disturbance ("Pre_SleepDisturbance_Tscore") and average pain rating exhibited a moderate correlation (r =.29, p =.007; r =-.39, p <.001, respectively). All other initial outcome responses showed a strong correlation as follows: Anger (r =-.44, p <.001), Anxiety (r =-.50, p <.001), Depression (r =-.62, p <.001), Fatigue (r =-.59, p <.001), Pain Behavior (r =-.59, p <.001), Pain Interference (r =-.71, p <.001), Physical Function (r =.58, p <.001), Sleep Related Impairment (r =-.51, p <.001), Social Satisfaction DSA (r =.62, p <.001), Social Satisfaction Role (r =.70, p <.001). After a Bonferroni correction, initial sleep disturbance and initial global health were no longer significantly correlated.

Correlation between illness perception and outcomes.

Change in illness perception and change in outcomes. As seen in Table 15, statistical analysis of the relationship between change in illness perception and change in outcome measures showed a moderate and significant correlation between illness perception ("Chng_BIPQ") and Depression ("Chng_Dep") (r =.39, p <.001) , Fatigue ("Chng_Fatigue") (r =.31, p =.02), Sleep Disturbance ("Chng_SleepDisturbance") (r =.33, p =.001), Sleep Related Impairment ("Chng_SlpRltdImp") (r =-.30, p =.002), Social Satisfaction DSA ("Chng_SocialSatDSA") (r =-.28, p =.005), and Social Satisfaction Role ("Chng_SocialSatRole") (r =-.44, p <.001). After a Bonferroni correction, changes in fatigue and social satisfaction DSA were no longer significantly correlated with change in illness perception. The strength of the relationship between change in illness perception and change in outcomes scores is not as strong as the relationship between global health and outcomes.

Initial illness perception and change in outcomes. Though "Chng_BIPQ" was correlated with several of the outcome measures, the baseline BIPQ score ("BIPQ_Total") did

not appear to have a significant relationship with change of any of the outcome measures (as shown in Table 14).

Initial illness perception and initial outcome responses. Similar to the results of the correlation between initial global health and initial outcome responses, baseline BIPQ score was significantly correlated with all of the initial outcome responses, except for PROMIS Sleep Disturbance (see Table 16). A strong correlation was found between "BIPQ_Total" and initial Anger (r =.41, p <.001), Anxiety (r =.40, p <.001), Depression (r =.51, p <.001), Pain Behavior (r =.41, p <.001), Pain Interference (r =.44, p <.001), Social Satisfaction Role (r =.45, p <.001), and Average Pain Rating (r =.42, p <.001) (Table 16). A moderate correlation was found between "BIPQ_Total" and initial Fatigue (r =.34, p <.001), Physical Function (r =-.28, p =.005), Sleep Related Impairment (r =.29, p =.003), and Social Satisfaction DSA (r =-.34, p =.001). After a Bonferroni correction, initial illness perception and initial physical function were no longer significantly correlated.

Change in Measures when Controlling for Initial Scores

A Repeated Measures ANCOVA was conducted to determine if the changes in scores over time for each variable of interest was significant when controlling for the initial scores. All changes in scores, for Global Health, BIPQ, PMQ, and outcome measures (PROMIS and Average Pain Rating), were found to be significant at p<.05. Specific results were as follows: Pain Rating F= 13.97, p<.01; Anger F= 30.21, p<.01; Anxiety F= 39.23, p<.01; Depression F=12.70, p<.01; Fatigue F= 17.57, p<.01; Pain Behavior F= 8.83, p<.01; Pain Interference F= 17.54, p< .01; Physical Function F= 20.13, p< .01; Sleep Disturbance F= 8.73, p< .01; Sleep Related Impairment F= 9.58, p< .01; Social Satisfaction DSA F= 44.89, p<.01; Social

Satisfaction Role $F = 27.48$, $p < .01$; BIPQ $F = 4.96$, $p = .03$; PMQ $F = 5.84$, $p = .02$; Global Health $F = 19.10$, $p < .01$. These values, as well as descriptive statistics for all measures can be found in Tables 17-46, respectively.

CHAPTER FIVE

Discussion

Demographic Data

The majority of participants included in the study were white, Non-Hispanic females. However, there were several participants who did not provide a response for race and/or ethnicity. A study by Johannes et al. (2010) found similar results: out of over 35,000 participants given a survey, the majority of those who responded were white non-Hispanics and were retired. It was also not surprising that more females than males were included in the study because research has shown that pain prevalence in women is consistently higher than in men (LeResche, 2011). Regarding gender differences, one factor to consider is pain intensity, as it has been found to influence whether or not a person seeks treatment (LeResche, 2011). Similar to pain intensity, perception of pain is also a determining factor of seeking treatment. Gender differences in the experience of pain are recognized, but not yet fully understood. The study by Johannes et al. (2010) also revealed that the prevalence of pain increased with age (through age 64) and was higher for females across all age groups. Across the literature, it has been found that comorbidities may affect the experience of pain, especially in elderly individuals (Molton & Terrill, 2014). For some, pain may not be their primary health concern, therefore it is either not reported at all or is perceived as less intense than it would be in the absence of other medical issues, thus explaining the overall decrease in prevalence of pain.

Age. Literature has shown a need for more research involving the treatment of elderly patients in many different settings, especially pain management. Approximately one-fourth of the participants included in this study were 64 years of age or older, which is more than the

portion of elderly in the general population. The population of people age 65 and older in the United States is about 13% and less than 12% in Texas (A Profile of Older Americans, 2012).

Age did not appear to be significantly correlated with change in any of the outcome measures responses (see Table 6), meaning that there was no difference in potential treatment effectiveness based on age alone. However, age did appear to have a small but significant negative correlation with the initial PROMIS Depression T-score, where depression scores seemed to decrease with increasing age. A lower initial depression score in older participants could be due to several factors, but since initial depression is the only PROMIS measure correlated with age, it is difficult to determine why this is the case. Since age was correlated with 12 different outcome measures, a Bonferroni correction was performed to account for multiple comparisons. After the correction, the correlation between age and initial depression score was no longer considered significant.

Age and initial BIPQ, PMQ, and global health. A small but significant negative correlation was also found between age and initial BIPQ, initial PMQ, and initial Global Health scores. It appeared that initial scores on illness perception, medication beliefs, and global health status were actually somewhat healthier in older participants. This could possibly be explained by the idea that older participants have been experiencing pain for a longer amount of time than younger participants and therefore their beliefs, perceptions, and overall view of health are slightly more positive because they have learned to adapt to their pain. Another hypothesis is that some elderly adults may believe that pain (and possibly other conditions) is simply a result of aging and that it is 'normal,' so the fact that they are experiencing pain may not have as much of an impact on their overall health or their perception of their illness.

Illness Perception, Medication Beliefs, and Global Health

Change in BIPQ, PMQ, and global health. The moderate and significant positive correlation between change in medication beliefs and change in illness perception supports the hypothesis that medication beliefs and illness perception covary, where a low score on one measure should be indicative of a low score on the other. However, this does not equate to causation. Though the results somewhat support the hypothesis, the moderate nature of the relationship may be interpreted to mean that a person at a higher risk for opioid misuse may not necessarily have poor illness perceptions and vice versa. A stronger (and significant) correlation was found between the change in BIPQ and the change in Global Health measure, as well as change in PMQ and change in Global Health. This was expected since global health is a measure of overall health and includes items that assess both beliefs and perceptions in a more general sense. A positive change in illness perception or medication beliefs would imply a positive change in global health status, and vice versa.

Initial BIPQ, PMQ, and global health. The correlation between initial illness perception and initial medication beliefs was similar to the correlation between change in illness perception and change in medication beliefs. If this correlation were much stronger, the initial scores on these two measures could possibly be used to predict discharge scores since the both the initial scores and change in scores were correlated at a similar level between the two measures.

A strong and significant positive correlation was found between both initial illness perception and initial global health and initial medication beliefs and initial global health. Initial responses on these three measures appear to be indicative of the amount of change in these three

measures from beginning to end of treatment. Overall, participants who have a seemingly negative view of their overall health appear to be more likely to also have a negative perception of their illness and/or a higher potential for opioid misuse. For example, based on the results, someone who has a negative initial view of global health would be expected to have a high BIPQ score. These scores would both either increase or decrease, based on the results of the study.

Global Health includes overall quality of life and does not specifically focus on illness or medications like the BIPQ and PMQ, but it is still considered a measure of health-related perceptions. Since Global Health encompasses some of the constructs measured on the BIPQ and PMQ, it may be a better predictor of treatment outcome than BIPQ or PMQ alone. Alternatively, Global Health score (with more research) may also be utilized to predict BIPQ or PMQ scores.

Global Health, Illness Perception, and Outcomes

Global health and outcomes.

***Change in global health and change in outcomes*.** Change in Global Health score was found to be significantly correlated with change in nearly every outcome measure. Large correlations between global health and the social satisfaction measures were expected because social satisfaction in a construct that the global health assessment seeks to measure. The only two outcome measures that were not associated with change in global health were change in Sleep Disturbance and change in Sleep-Related Impairment, and Anger was not significantly correlated after a Bonferroni correction. Generally, participants who experienced a positive change in global health score after receiving treatment also made improvements on the majority of the PROMIS measures, meaning that treatment had a beneficial impact on overall perceptions

and experiences of participants' health conditions. This supported the hypothesis that health-related perceptions are correlated with treatment outcome.

Initial global health and change in outcomes. Though the results showed that change in global health is in fact correlated with change in treatment outcomes, the relationship between baseline global health and change in treatment outcomes also needed to be examined. This relationship was not as strong, but still statistically significant. Moderate correlations were found between baseline Global Health and change in Pain Interference, Anxiety, and Social Satisfaction DSA. Simply stated, a healthy view of global health at the baseline time point is likely indicative of positive change in those specific outcome measures from baseline to discharge. In other words, people who score higher initially on Global Health are more likely to perceive a benefit from certain aspects of treatment. However, correlation does not imply causation, and there are other factors to be examined in order to determine what causes the change in outcome measurements.

Initial global health and initial outcome responses. Lastly, a correlation was also run between initial Global Health and initial outcome measure responses in order to provide even more insight into this relationship. These appeared to have a stronger relationship overall than the relationship between initial global health and change in outcomes. All initial outcome measures were found to be significantly correlated with initial global health scores, except for Sleep Disturbance.

Illness Perception and Outcomes

Change in illness perception and change in outcomes. Moderate and significant correlations were found between change in Illness Perception and change in outcome measures,

specifically Depression, Sleep Disturbance, Sleep-Related Impairment, and Social Satisfaction Role. The strength of the relationship between change in illness perception and change in outcomes scores is not as strong as the relationship between global health and outcomes; however, a positive change in illness perception is still, to some degree, associated with a positive change in outcome measures. This is expected given the results of the strength of the correlations in the first hypothesis. Global Health would be expected to have a stronger correlation with outcome measures because it is a more general and more inclusive measure than the BIPQ, and global health appears to be the measure that is most strongly and significantly correlated with treatment outcomes.

Initial illness perception and change in outcomes. As with Global Health, a correlation was run between baseline BIPQ and change in outcome measures. Unlike Global Health, however, no significant relationship was found between initial BIPQ scores and change in outcome measures. Initial BIPQ does not appear to effect treatment outcome, meaning that a severe illness perception score does not necessarily imply that treatment will not be helpful. Poor initial illness perception does not mean that a patient cannot benefit from treatment. Though this does not necessarily support the hypothesis, this relationship is important because it brings up the idea that illness perception can change over time. Therefore, proper treatment would be likely to change one's illness perceptions and allow for some benefit from treatment.

Initial illness perception and initial outcome responses. Although baseline BIPQ and change in treatment outcomes are not correlated, baseline BIPQ and baseline outcome responses appeared to be significantly correlated, with the exception of PROMIS Sleep Disturbance and Physical Function. The current study supports the hypothesis and the previous finding that high

BIPQ score is associated with "poorer physical, social, and psychological functioning" (Lochting et al., 2013), as evidenced by the positive correlation between baseline BIPQ and baseline outcome measures. Initial BIPQ scores appear to be somewhat indicative of initial outcome measure scores, and vice versa. Initial emotional responses as measured by the various outcomes are presumably a result of underlying thoughts (as measured by initial BIPQ).

Change in Scores when Controlling for Initial Score

The changes in scores from baseline to discharge for all measures (BIPQ, PMQ, Global Health, and outcome measures) was found to be significant even when controlling for baseline scores. Participants with high baseline scores would be expected to change significantly with treatment, so controlling for baseline scores allowed for a more accurate interpretation of whether or not the changes were actually significant. For instance, we would not expect an individual with low levels of depressive symptoms to change significantly with treatment. This finding shows that treatment is effective and produces statistically significant changes, but the clinical significance of these changes should still be examined.

Limitations of the Current Study

The measures analyzed in the study are all self-report measures, so it would be quite difficult to determine the accuracy of patients' perceptions of their conditions. However, since the experience of pain is so subjective, basing treatment off of patient-report is the only option we have, whether patients are dramatizing their pain levels or not.

Though the demographics of the included participants appeared to be consistent with known pain population demographics, it is hard to be sure that this sample is representative of the population since many participants' race and/or ethnicity was not provided.

The true strength of correlation between some of the measures may actually differ from what was observed since some of the discharge scores were actually midpoint scores that were carried forward. The true strength of correlation may also have been slightly different if average scores on individual items had not been substituted for missing responses on the BIPQ and PMQ.

Future Research Implications

In order to further examine the relationship between age and treatment outcome, as well as age and initial responses to Assessment Center items, additional studies with a greater sample size may be helpful. This study establishes some degree of correlation between medication beliefs and illness perception, as well as medication beliefs and global health scores; however, the relationship between medication beliefs and treatment outcomes was not explored. This could be another area of future interest, especially with regard to treatment planning for those who score high on the PMQ and are at risk for opioid misuse. Similar studies, using the same outcome measures, could be run with different independent variables. For example, examining the relationship between number of comorbidities and both initial Assessment Center item responses and discharge Assessment Center item responses.

Though the measures included in Assessment Center are thorough and clinically useful, some participants are simply not able to complete all of the survey, especially for initial evaluation. This may be due to time constraints or a number of other reasons. Therefore, future studies assessing which of these measures provide the strongest, most clinically useful information could ultimately decrease testing time and possibly result in more accurate responses from participants.

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Appendix A

Data Analysis Tables

Table 1

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	27	26.2	26.2	26.2
	Female	76	73.8	73.8	100.0
	Total	103	100.0	100.0	

Table 2

Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	56	54.4	54.4	54.4
	African American	10	9.7	9.7	64.1
	Native Hawaiian or Pacific Islanders	2	1.9	1.9	66.0
	Hispanic	3	2.9	2.9	68.9
	Not Provided	32	31.1	31.1	100.0
	Total	103	100.0	100.0	

Table 3

Ethnicity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Provided	35	34.0	34.0	34.0
	Not Hispanic/Latino	60	58.3	58.3	92.2
	Hispanic or Latino	8	7.8	7.8	100.0
	Total	103	100.0	100.0	

Table 4

Age

		Age
N	Valid	103
	Missing	0
Mean		54.03
Median		56.00
Std. Deviation		14.06
Minimum		20
Maximum		82
Percentiles	25	45.00
	50	56.00
	75	64.00

Table 5

Age and Initial Outcome Scores

		Age
Pre_Anger_Tscore	Pearson Correlation	-.140
	Sig. (2-tailed)	.160
	N	103
Pre_Anxiety_Tscore	Pearson Correlation	-.145
	Sig. (2-tailed)	.144
	N	103
Pre_Depression_Tscore	Pearson Correlation	-.208*
	Sig. (2-tailed)	.035
	N	103
Pre_Fatigue_Tscore	Pearson Correlation	-.021
	Sig. (2-tailed)	.835
	N	103
Pre_PainBehavior_Tscore	Pearson Correlation	-.091
	Sig. (2-tailed)	.362
	N	103
Pre_PainInterference_Tscore	Pearson Correlation	-.095
	Sig. (2-tailed)	.341
	N	103
Pre_PhysicalFunction_Tscore	Pearson Correlation	.005
	Sig. (2-tailed)	.956
	N	103
Pre_SleepDisturbance_Tscore	Pearson Correlation	-.188
	Sig. (2-tailed)	.058
	N	103
Pre_SleepRelatedImpairment_Tscore	Pearson Correlation	-.133
	Sig. (2-tailed)	.179
	N	103
Pre_SocialSatDSA_Tscore	Pearson Correlation	-.122
	Sig. (2-tailed)	.220
	N	103

Note. PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
*. Correlation is significant at the 0.05 level (2-tailed).

Table 5 (continued)

Age and Initial Outcome Scores

		Age
Pre_SocialSatRole_Tscore	Pearson Correlation	-.145
	Sig. (2-tailed)	.144
	N	103
AvgPain_PrevWeek	Pearson Correlation	-.171
	Sig. (2-tailed)	.085
	N	103

Note. PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6

Age and Change in Outcome Scores

		Age
Chng_PainInt	Pearson Correlation	.131
	Sig. (2-tailed)	.188
	N	102
Chng_Anger	Pearson Correlation	.010
	Sig. (2-tailed)	.923
	N	103
Chng_Anx	Pearson Correlation	.015
	Sig. (2-tailed)	.882
	N	103
Chng_Dep	Pearson Correlation	-.016
	Sig. (2-tailed)	.872
	N	103
Chng_Fatigue	Pearson Correlation	.114
	Sig. (2-tailed)	.253
	N	103
Chng_PainBehavior	Pearson Correlation	.096
	Sig. (2-tailed)	.334
	N	103
Chng_PhysFunction	Pearson Correlation	.101
	Sig. (2-tailed)	.311
	N	102
Chng_SleepDisturbance	Pearson Correlation	-.035
	Sig. (2-tailed)	.731
	N	101

Note. PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6 (continued)

Age and Change in Outcome Scores

		Age
Chng_SlpRltdImp	Pearson Correlation	.004
	Sig. (2-tailed)	.966
	N	102
Chng_SocialSatDSA	Pearson Correlation	-.064
	Sig. (2-tailed)	.520
	N	102
Chng_SocialSatRole	Pearson Correlation	.046
	Sig. (2-tailed)	.649
	N	102
Chng_AVGPain	Pearson Correlation	-.050
	Sig. (2-tailed)	.618
	N	102

Note. PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7

Age and Initial Scores

		BIPQ_Total	PMQ_Total	Total_Global
Age	Pearson Correlation	-.197*	-.219*	-.216*
	Sig. (2-tailed)	.048	.040	.044
	N	102	88	87

Note. Global Health scores are reversed;
*. Correlation is significant at the 0.05 level (2-tailed).

Table 8

Baseline Score Frequencies

		BIPQ_Total	PMQ_Total	Total_Global
N	Valid	102	88	87
	Missing	1	15	16
Mean		50.8235	21.4545	27.6552
Std. Deviation		10.84126	7.21255	6.84518
Minimum		13.00	4.00	15.00
Maximum		75.00	39.00	48.00

Table 9

Discharge Score Frequencies

		POST_BIPQ_Total	POST_PMQ_Total	POST_Total_Global
N	Valid	98	71	83
	Missing	5	32	20
Mean		44.7143	19.8873	29.8795
Std. Deviation		11.50706	8.12676	7.44148
Minimum		3.00	5.00	13.00
Maximum		65.00	47.00	45.00

Table 10

Baseline Outcome Frequencies

		1	2	3	4	5	6
N	Valid	103	103	103	103	103	103
	Missing	0	0	0	0	0	0
Mean		6.32	52.137	56.784	55.417	60.951	59.261
Median		6.00	52.800	57.000	54.400	60.900	60.000
Std. Deviation		2.083	8.8628	8.1530	8.1558	8.0930	4.0748
Minimum		1	28.6	32.9	34.2	39.1	44.8
Maximum		10	73.4	76.2	74.6	79.0	71.5

Table 10 (continued)

Baseline Outcome Frequencies

		7	8	9	10	11	12
N	Valid	103	103	103	103	103	103
	Missing	0	0	0	0	0	0
Mean		63.909	36.676	57.032	58.091	40.381	37.977
Median		65.300	35.900	57.300	59.700	40.200	37.400
Std. Deviation		6.9582	6.2978	7.5681	6.5232	7.9237	8.2717
Minimum		38.6	23.5	35.1	42.4	26.8	25.1
Maximum		80.1	55.8	73.4	70.7	68.9	67.8

Note. 1= AvgPain_PrevWeek; 2= Anger_Tscore; 3= Anxiety_Tscore; 4= Depression_Tscore; 5=Fatigue_Tscore; 6= BainBehavior_Tscore; 7= PainInterference_Tscore; 8=PhysicalFunction_Tscore; 9= SleepDisturbance_Tscore; 10=SleepRelatedImpairment_Tscore; 11= SocialSatDSA_Tscore; 12= SocialSatRole_Tscore.

Table 11

Discharge Outcome Frequencies

		1	2	3	4	5	6
N	Valid	102	103	103	103	103	103
	Missing	1	0	0	0	0	0
Mean		4.83	51.250	55.577	53.425	57.862	57.439
Median		5.00	50.300	55.800	53.400	57.100	57.500
Std. Deviation		2.189	8.5240	7.4559	8.8994	8.2404	5.9389
Minimum		0	28.6	32.9	34.2	34.4	35.3
Maximum		10	72.6	71.3	78.1	77.7	71.5

Table 11 (continued)

Discharge Outcome Frequencies

		7	8	9	10	11	12
N	Valid	102	102	101	102	102	102
	Missing	1	1	2	1	1	1
Mean		60.860	38.982	55.514	56.576	43.168	41.162
Median		61.500	39.500	55.800	56.100	43.100	41.800
Std. Deviation		7.4662	6.5077	9.2015	8.0937	7.8212	8.5646
Minimum		38.6	27.0	30.7	26.2	26.8	25.1
Maximum		83.8	55.8	81.2	78.2	68.9	63.3

Note. 1= AvgPain_PrevWeek; 2= Anger_Tscore; 3= Anxiety_Tscore; 4= Depression_Tscore; 5=Fatigue_Tscore; 6= BainBehavior_Tscore; 7= PainInterference_Tscore; 8=PhysicalFunction_Tscore; 9= SleepDisturbance_Tscore; 10=SleepRelatedImpairment_Tscore; 11= SocialSatDSA_Tscore; 12= SocialSatRole_Tscore.

Table 12

Relationship Between Change in BIPQ, PMQ, and Global Scores

		Chng_BIPQ	Chng_PMQ	Chng_Global
Chng_BIPQ	Pearson Correlation	-		
	Sig. (2-tailed)			
	N			
Chng_PMQ	Pearson Correlation	.281*	-	
	Sig. (2-tailed)	.026		
	N	63		
Chng_Global	Pearson Correlation	.540**	.468**	-
	Sig. (2-tailed)	.000	.001	
	N	76	49	

Note. Global Health scores are reversed;
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 13

Relationship Between Initial BIPQ, PMQ, and Global Scores

		BIPQ_Total	PMQ_Total	Total_Global
BIPQ_Total	Pearson Correlation	-		
	Sig. (2-tailed)			
	N			
PMQ_Total	Pearson Correlation	.269*	-	
	Sig. (2-tailed)	.012		
	N	87		
Total_Global	Pearson Correlation	.572**	.401**	-
	Sig. (2-tailed)	.000	.000	
	N	87	73	

Note. Global Health scores are reversed; **. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed).

Table 14

Relationship Between Change in Outcomes and Initial BIPQ, PMQ, and Global Scores

		BIPQ_Total	PMQ_Total	Total_Global
Chng_PainInt	Pearson Correlation	-.032	.158	.372**
	Sig. (2-tailed)	.748	.144	.000
	N	101	87	86
Chng_Anger	Pearson Correlation	.191	.071	.298**
	Sig. (2-tailed)	.054	.514	.005
	N	102	88	87
Chng_Anx	Pearson Correlation	.188	.181	.341**
	Sig. (2-tailed)	.059	.091	.001
	N	102	88	87
Chng_Dep	Pearson Correlation	.182	.008	.242*
	Sig. (2-tailed)	.067	.939	.024
	N	102	88	87
Chng_Fatigue	Pearson Correlation	.040	-.047	.168
	Sig. (2-tailed)	.687	.661	.119
	N	102	88	87
Chng_PainBehavior	Pearson Correlation	-.155	.026	.155
	Sig. (2-tailed)	.121	.812	.153
	N	102	88	87

Note. Global Health scores are reversed;
**. Correlation is significant at the 0.01 level (2-tailed);
*. Correlation is significant at the 0.05 level (2-tailed).

Table 14 (continued)

Relationship Between Change in Outcomes and Initial BIPQ, PMQ, and Global Scores

		BIPQ_Total	PMQ_Total	Total_Global
Chng_PhysFunction	Pearson Correlation	-.160	.127	.071
	Sig. (2-tailed)	.109	.240	.518
	N	101	87	86
Chng_SleepDisturbance	Pearson Correlation	.048	.176	.090
	Sig. (2-tailed)	.633	.104	.413
	N	100	86	85
Chng_SlpRltdImp	Pearson Correlation	.015	.089	.075
	Sig. (2-tailed)	.883	.415	.493
	N	101	87	86
Chng_SocialSatDSA	Pearson Correlation	.048	.003	.234*
	Sig. (2-tailed)	.633	.977	.030
	N	101	87	86
Chng_SocialSatRole	Pearson Correlation	.124	-.062	.128
	Sig. (2-tailed)	.215	.566	.241
	N	101	87	86
Chng_AVGPain	Pearson Correlation	.175	.222*	.287**
	Sig. (2-tailed)	.080	.039	.007
	N	101	87	86

Note. Global Health,PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 15

Relationship Between Change in Outcomes and Change in BIPQ, PMQ, and Global Scores

		Chng_BIPQ	Chng_PMQ	Chng_Global
Chng_PainInt	Pearson Correlation	.263**	.337**	.648**
	Sig. (2-tailed)	.009	.005	.000
	N	97	67	76
Chng_Anger	Pearson Correlation	.185	.247*	.271*
	Sig. (2-tailed)	.069	.043	.018
	N	97	68	76
Chng_Anx	Pearson Correlation	.290**	.184	.415**
	Sig. (2-tailed)	.004	.134	.000
	N	97	68	76
Chng_Dep	Pearson Correlation	.388**	.358**	.550**
	Sig. (2-tailed)	.000	.003	.000
	N	97	68	76
Chng_Fatigue	Pearson Correlation	.307**	.141	.461**
	Sig. (2-tailed)	.002	.253	.000
	N	97	68	76
Chng_PainBehavior	Pearson Correlation	.063	.348**	.356**
	Sig. (2-tailed)	.542	.004	.002
	N	97	68	76

Note. Global Health scores are reversed;

**. Correlation is significant at the 0.01 level (2-tailed);

*. Correlation is significant at the 0.05 level (2-tailed).

Table 15 (continued)

Relationship Between Change in Outcomes and Change in BIPQ, PMQ, and Global Scores

		Chng_BIPQ	Chng_PMQ	Chng_Global
Chng_PhysFunction	Pearson Correlation	.232*	.228	.443**
	Sig. (2-tailed)	.022	.063	.000
	N	97	67	76
Chng_SleepDisturbance	Pearson Correlation	.328**	.059	.178
	Sig. (2-tailed)	.001	.639	.128
	N	96	66	75
Chng_SlpRltdImp	Pearson Correlation	.304**	.025	.004
	Sig. (2-tailed)	.002	.843	.972
	N	97	67	76
Chng_SocialSatDSA	Pearson Correlation	.283**	.236	.460**
	Sig. (2-tailed)	.005	.054	.000
	N	97	67	76
Chng_SocialSatRole	Pearson Correlation	.441**	.217	.547**
	Sig. (2-tailed)	.000	.078	.000
	N	97	67	76
Chng_AVGPain	Pearson Correlation	.304**	.264*	.479**
	Sig. (2-tailed)	.003	.031	.000
	N	96	67	76

Note. Global Health,PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
**. Correlation is significant at the 0.01 level (2-tailed);
*. Correlation is significant at the 0.05 level (2-tailed).

Table 16

Relationship Between Baseline Total Scores and Baseline Outcome Measure Responses

		BIPQ_Total	PMQ_Total	Total_Global
Pre_Anger_Tscore	Pearson Correlation	.405**	.107	.443**
	Sig. (2-tailed)	.000	.322	.000
	N	102	88	87
Pre_Anxiety_Tscore	Pearson Correlation	.395**	.217*	.498**
	Sig. (2-tailed)	.000	.043	.000
	N	102	88	87
Pre_Depression_Tscore	Pearson Correlation	.514**	.192	.617**
	Sig. (2-tailed)	.000	.073	.000
	N	102	88	87
Pre_Fatigue_Tscore	Pearson Correlation	.341**	.071	.593**
	Sig. (2-tailed)	.000	.514	.000
	N	102	88	87
Pre_PainBehavior_Tscore	Pearson Correlation	.411**	.221*	.592**
	Sig. (2-tailed)	.000	.038	.000
	N	102	88	87
Pre_PainInterference_Tscore	Pearson Correlation	.439**	.288**	.707**
	Sig. (2-tailed)	.000	.006	.000
	N	102	88	87

Note. Global Health scores are reversed;
**. Correlation is significant at the 0.01 level (2-tailed);
*. Correlation is significant at the 0.05 level (2-tailed).

Table 16 (continued)

Relationship Between Baseline Total Scores and Baseline Outcome Measure Responses

		BIPQ_Total	PMQ_Total	Total_Global
Pre_PhysicalFunction_Tscore	Pearson Correlation	.277**	.163	.577**
	Sig. (2-tailed)	.005	.129	.000
	N	102	88	87
Pre_SleepDisturbance_Tscore	Pearson Correlation	.142	.148	.285**
	Sig. (2-tailed)	.155	.168	.007
	N	102	88	87
Pre_SleepRelatedImpairment_Tscore	Pearson Correlation	.288**	.184	.507**
	Sig. (2-tailed)	.003	.086	.000
	N	102	88	87
Pre_SocialSatDSA_Tscore	Pearson Correlation	.335**	.047	.622**
	Sig. (2-tailed)	.001	.667	.000
	N	102	88	87
Pre_SocialSatRole_Tscore	Pearson Correlation	.448**	.230*	.700**
	Sig. (2-tailed)	.000	.031	.000
	N	102	88	87
AvgPain_PrevWeek	Pearson Correlation	.417**	.308**	.392**
	Sig. (2-tailed)	.000	.004	.000
	N	102	88	87

Note. Global Health,PhysicalFunction, SocialSatDSA, and SocialSatRole scores are reversed;
**. Correlation is significant at the 0.01 level (2-tailed);
*. Correlation is significant at the 0.05 level (2-tailed).

Table 17

Descriptive Statistics: Pain Rating

	Mean	Std. Deviation	N
AvgPain_PrevWeek	6.32	2.093	102
POST_AvgPain_PrevWeek	4.83	2.189	102

Table 18

Repeated Measures ANCOVA: Pain Rating

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	29.329	1	29.329	13.967	.000	.123
Time * Covar_Avg Pain	Sphericity Assumed	84.756	1	84.756	40.362	.000	.288

Table 19

Descriptive Statistics: Anger

	Mean	Std. Deviation	N
Pre_Anger_Tscore	52.137	8.8628	103
POST_Anger_Tscore	51.250	8.5240	103

Table 20

Repeated Measures ANCOVA: Anger

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	755.621	1	755.621	30.207	.000	.230
Time * Covar_Anger	Sphericity Assumed	838.403	1	838.403	33.517	.000	.249

Table 21

Descriptive Statistics: Anxiety

	Mean	Std. Deviation	N
Pre_Anxiety_Tscore	56.784	8.1530	103
POST_Anxiety_Tscore	55.577	7.4559	103

Table 22

Repeated Measures ANCOVA: Anxiety

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	779.268	1	779.268	39.228	.000	.280
Time * Covar_Anxiety	Sphericity Assumed	866.552	1	866.552	43.622	.000	.302

Table 23

Descriptive Statistics: Depression

	Mean	Std. Deviation	N
Pre_Depression_Tscore	55.417	8.1558	103
POST_Depression_Tscore	53.425	8.8994	103

Table 24

Repeated Measures ANCOVA: Depression

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	327.649	1	327.649	12.698	.001	.112
Time * Covar_Depression	Sphericity Assumed	415.671	1	415.671	16.109	.000	.138

Table 25

Descriptive Statistics: Fatigue

	Mean	Std. Deviation	N
Pre_Fatigue_Tscore	60.951	8.0930	103
POST_Fatigue_Tscore	57.862	8.2404	103

Table 26

Repeated Measures ANCOVA: Fatigue

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	389.924	1	389.924	17.567	.000	.148
Time * Covar_Fatigue	Sphericity Assumed	522.007	1	522.007	23.518	.000	.189

Table 27

Descriptive Statistics: Pain Behavior

	Mean	Std. Deviation	N
Pre_PainBehavior_Tscore	59.261	4.0748	103
POST_PainBehavior_Tscore	57.439	5.9389	103

Table 28

Repeated Measures ANCOVA: Pain Behavior

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	132.997	1	132.997	8.827	.004	.080
Time * Covar_PainBehavior	Sphericity Assumed	155.108	1	155.108	10.295	.002	.093

Table 29

Descriptive Statistics: Pain Interference

	Mean	Std. Deviation	N
Pre_PainInterference_Tscore	63.867	6.9794	102
POST_PainInterference_Tscore	60.860	7.4662	102

Table 30

Repeated Measures ANCOVA: Pain Interference

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	352.460	1	352.460	17.537	.000	.149
Time * Covar_PainInt	Sphericity Assumed	450.275	1	450.275	22.404	.000	.183

Table 31

Descriptive Statistics: Physical Function

	Mean	Std. Deviation	N
Pre_PhysicalFunction_Tscore	36.723	6.3108	102
POST_PhysicalFunction_Tscore	38.982	6.5077	102

Table 32

Repeated Measures ANCOVA: Physical Function

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	214.676	1	214.676	20.127	.000	.168
Time * Covar_Phys Function	Sphericity Assumed	146.525	1	146.525	13.737	.000	.121

Table 33

Descriptive Statistics: Sleep Disturbance

	Mean	Std. Deviation	N
Pre_SleepDisturbance_Tscore	57.014	7.5674	101
POST_SleepDisturbance_Tscore	55.514	9.2015	101

Table 34

Repeated Measures ANCOVA: Sleep Disturbance

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	259.895	1	259.895	8.725	.004	.081
Time * Covar_SlpDist	Sphericity Assumed	312.196	1	312.196	10.481	.002	.096

Table 35

Descriptive Statistics: Sleep Related Impairment

	Mean	Std. Deviation	N
Pre_SleepRelatedImpairment_Tscore	58.075	6.5531	102
POST_SleepRelatedImpairment_Tscore	56.576	8.0937	102

Table 36

Repeated Measures ANCOVA: Sleep Related Impairment

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	230.173	1	230.173	9.582	.003	.087
Time * Covar_SlpRltdImp	Sphericity Assumed	271.196	1	271.196	11.290	.001	.101

Table 37

Descriptive Statistics: Social Satisfaction DSA

	Mean	Std. Deviation	N
Pre_SocialSatDSA_Tscore	40.455	7.9267	102
POST_SocialSatDSA_Tscore	43.168	7.8212	102

Table 38

Repeated Measures ANCOVA: Social Satisfaction DSA

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	1061.714	1	1061.714	44.892	.000	.310
Time * Covar_SocSatDSA	Sphericity Assumed	865.552	1	865.552	36.598	.000	.268

Table 39

Descriptive Statistics: Social Satisfaction Role

	Mean	Std. Deviation	N
Pre_SocialSatRole_Tscore	37.996	8.3102	102
POST_SocialSatRole_Tscore	41.162	8.5646	102

Table 40

Repeated Measures ANCOVA: Social Satisfaction Role

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	603.393	1	603.393	27.476	.000	.216
Time * Covar_SocSatRole	Sphericity Assumed	408.801	1	408.801	18.615	.000	.157

Table 41

Descriptive Statistics: Brief Illness Perception Questionnaire

	Mean	Std. Deviation	N
BIPQ_Total	50.9794	10.86660	97
POST_BIPQ_Total	44.7423	11.56348	97

Table 42

Repeated Measures ANCOVA: Brief Illness Perception Questionnaire

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	195.216	1	195.216	4.964	.028	.050
Time * Covar_BIPQ_ Total	Sphericity Assumed	551.948	1	551.948	14.036	.000	.129

Table 43

Descriptive Statistics: Pain Medication Questionnaire

	Mean	Std. Deviation	N
PMQ_Total	21.5882	7.05043	68
POST_PMQ_Total	19.7794	8.27304	68

Table 44

Repeated Measures ANCOVA: Pain Medication Questionnaire

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	149.662	1	149.662	5.841	.018	.081
Time * Covar_PMQ_ Total	Sphericity Assumed	265.023	1	265.023	10.342	.002	.135

Table 45

Descriptive Statistics: Global Health

	Mean	Std. Deviation	N
Total_Global	27.4737	7.06253	76
POST_Total_Global	30.4079	7.36510	76

Table 46

Repeated Measures ANCOVA: Global Health

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	286.535	1	286.535	19.099	.000	.205
Time * Covar_Total_Global	Sphericity Assumed	165.162	1	165.162	11.009	.001	.130

BIOGRAPHICAL SKETCH

Megan Mader
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EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Texas A&M University	B.A.	2012	Chemistry
The University of Texas Southwestern School of Health Professions	M.R.C.	2014 (in process)	Rehabilitation Counseling

Positions and Employment

2011-present Pharmacy Technician at CVS.
2014-present Homework Coach

Clinical Experience

2013-2014 Individual counseling, PSA Group co-facilitator, Intern at Zale-Lipshy Hospital, Neuropsychology Intern.