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Chronic Pain Causal Attributions in an Interdisciplinary Primary Care Clinic: Patient-Provider and Provider-Provider Discrepancies

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CHRONIC PAIN CAUSAL ATTRIBUTIONS IN AN INTERDISCIPLINARY
PRIMARY CARE CLINIC: PATIENT-PROVIDER AND
PROVIDER-PROVIDER DISCREPANCIES

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University

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Table of Contents

List of Tables

Abstract

CHRONIC PAIN CAUSAL ATTRIBUTIONS IN AN INTERDISCIPLINARY
PRIMARY CARE CLINIC: POTENTIAL DISCREPANCIES BETWEEN PATIENT
AND PROVIDERS

By Bryan James Jensen, Ph.D.

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University

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Major Director: Stephen M. Auerbach, Ph.D.
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The purpose of the present study was to investigate the influence of pain causal

attributions on patient pain-related functioning, treatment engagement, and clinical

outcomes. Additionally, the impact of discordant pain causal attributions between

patients and their providers as well as between interdisciplinary providers was examined.

Sixteen internal medicine residents and six behavioral medicine trainees served as

providers. Eighty chronic pain patients sampled from the residents' patient pool served as

subjects. Patients rated their pain functioning and causal pain attributions during a regular

clinic visit. They also met with a behavioral medicine provider who performed a brief

chronic pain assessment. Following the patient's visit both the behavioral medicine provider and internal medicine resident provided ratings of similar pain-related functioning domains and causal attributions. Follow-up data were collected from the electronic medical record three months following that clinic visit. Overall, results revealed that patients' chronic pain attributions did influence pain-related functioning, however the impact was relatively small. There was insufficient evidence to conclude that chronic pain attributions influence a patient's readiness to adopt self-management coping strategies and their subsequent treatment engagement. Additionally, results confirmed that different health care disciplines attribute the cause of patients' chronic pain in distinct ways and these unique perspectives can lead to discrepant pain-related functioning assessments between providers. Discordant ratings between providers were shown to influence referring patterns for interdisciplinary services and the patient's overall opioid dose. Similarly, discrepancies between patients and their providers influenced subsequent referral for behavioral health services, the patient's attendance at those visits, and their overall morphine equivalent doses. Referrals for behavioral medicine services were associated with discordant ratings of opioid abuse risk and psychological attributions of pain. Patients were less likely to attend interdisciplinary visits when patient-provider discrepancies were high on assessments of depression and pain intensity. Discrepant views of depression and pain intensity were also predictive of patients being prescribed high opioid doses. Together the results indicate the important role pain attributions can play in chronic pain management and highlight the central role of the patient-provider and provider-provider relationship.

Chronic Pain Causal Attributions in an Interdisciplinary Primary Care Clinic: Patient-Provider and Provider-Provider Discrepancies

Chronic pain is a pervasive condition affecting millions of individuals and families. In the United Stated roughly one third of the population, 100 million adults, suffer from chronic pain (Institute of Medicine, 2011), with some lifetime estimates as high as 85% (Centers for Disease Control, 2006). If families and "significant others" of those experiencing chronic pain are considered, that leaves relatively few individuals not affected in some way by the chronic pain experience (Turk, 2002). Chronic pain conditions account for up to $635 billion annually in medical costs and lost productivity (Institute of Medicine, 2011). These costs are thought to exceed the costs of treating patients with AIDS, coronary artery disease, and cancer combined (Turk, 2002). The economic and societal burden of chronic pain is only made worse by the co-morbid emotional struggles individuals experience with chronic pain (see Gatchel, Peng, Fuchs, Peters & Turk, 2007).

The benchmark definition of pain as put forth by the International Association for the Study of Pain (IASP, 1994) indicates pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." This was an important step away from a purely biological definition of pain based on nociception. Nociception is the process by which noxious stimulation is detected via nociceptors within the peripheral nervous system, physiologically

transmitted, and unconsciously processed by an organism (Barrot, 2012). The IASP's definition however importantly includes the role of emotional processes in the pain experience (Lumley et al., 2011). This is consistent with broader evidence that pain is the resulting experience of an organism's interpretation of multiple cortical and subcortical systems, including nociceptive inputs, which manifest through cognitive, emotional, and social expressions (see Barrot, 2012; Legrain, Iannetti, Plaghki, & Mouraux, 2011). Similarly, the IASP conceptualization of pain is consistent with our understanding that pain can be experienced even in the absence of tissue damage, which is particularly important when considering chronic pain. Chronic pain has been generally separated from acute types of pain based on the duration of symptoms. A number of time-period cut-offs (e.g., 1, 3, 6 months) are in current use to define chronic pain, however the most commonly used criteria is for pain to persist for three months or longer (Turk, Wilson, & Cahana, 2011). Together, recognizing that pain is subjective and involves biological, cognitive, affective, and behavioral neuropathology has led to our current biopsychosocial conceptualization of chronic pain (Gatchel et al., 2007).

Viewing pain as a biopsychosocial experience suggests that we assess and treat it in like fashion. The evidence now strongly supports the use of interdisciplinary teams for the management of chronic pain (see Gatchel, McGeary, McGeary, & Lippe, 2014). Interdisciplinary treatment is optimally suited to address the biopsychosocial nature of pain and has been shown to not only be clinically effective but cost saving (Flor et al., 1992; Gatchel et al., 2014; Gatchel & Okifuji, 2006; Turk, 2002). However, many barriers have stunted the growth and implementation of interdisciplinary pain programs (Gatchel et al., 2014) and as interest continues to trend towards team-based medical

homes (Davis, Abrams, & Stremikis, 2011; Jacobson & Jazowski, 2011), the primary

care setting is potentially a more pragmatic setting to implement interdisciplinary chronic

pain interventions (Debar et al., 2012). Estimates indicate the prevalence of chronic pain

to be between 5-33% in primary care settings (Reid et al., 2002) with these patients

utilizing primary care services up to five times more than those without chronic pain

(Von Korff, Wagner, Dworkin, & Saunders, 1991). However, chronic pain patients are

not always open to interdisciplinary services (i.e., physical therapy, behavioral

treatments). Patients' motivation toward self-management of pain has shown to increase

during multidisciplinary treatment (Jensen, Nielson, Turner, Romano, & Hill, 2004) and

is likely influenced by specific perceptions they have about their chronic pain. Primary

care based interdisciplinary pain management might be the most viable setting for

addressing the burgeoning chronic pain problem. Understanding patient perceptions

about their pain and motivation for self-care should provide valuable insight for

successful implementation.

     Initiatives to improve chronic pain management also point to the need for more

comprehensive assessment (Institute of Medicine, 2011; Turk et al., 2003). This includes

assessing patients' pain intensity, pain-related functional impairments, emotional

functioning, potential adverse effects related to treatment, and satisfaction (Dansie &

Turk, 2013; Turk et al., 2003). This information provides clinicians with the necessary

information to make appropriate decisions during the treatment process. However, it is

also important to recognize the basic social and cognitive processes that comprise the

chronic pain assessment process. Since providers are reliant on patient self-report, the

most basic process to consider is that patients must evaluate their own experience.

Attributions of causality, pain related beliefs, and expectations for treatment and coping are then important sources of information (Hagger & Orbell, 2003; Kaptein et al., 2010; Moss-Morris et al., 2002). Patients subsequently report this information and providers are left to consider the validity of these reports. Ample evidence suggests that providers do not always consider patient reports accurate or trustworthy (Panda et al., 2006; Tait & Chibnall, 2014) and are more likely to make treatment decisions based off of more objective sources of information (e.g., diagnostic tests, functional measures, laboratory results) and deemphasize the patients' evaluation (Gvozdenovic et al., 2014; Khan et al., 2012; Studenic et al., 2012; Yen et al., 2003). Thus, the process of assessing chronic pain is a dynamic social transaction (Schiavenato & Craig, 2010) and despite a medical preference for objective and standardized information, chronic pain assessment is influenced by basic subjective perceptions about the nature of a patient's pain experience (Tait & Chibnall, 2014).

In recent years a limited literature has emerged that has evaluated the impact of discrepant patient-physician ratings of pain on clinical outcomes. It has been established for a variety of chronic pain conditions that discordant pain intensity ratings are associated with poorer clinical outcomes (Panda et al., 2006; Shugarman et al., 2010), however knowledge regarding discrepancies in other pain related domains (i.e. causal pain attributions, functional impairment, depression, opioid abuse risk) is largely non-existent. Additionally, there is no consideration given to potential provider-provider discrepancies that can arise within interdisciplinary settings.

The present study seeks to fill these gaps in the literature by evaluating the influence of pain causal attributions in the chronic pain assessment and treatment process.

The first aim is to determine the influence of a patient's causal attributions about chronic pain on pain related outcomes. This will include examining the relationship between causal attributions and a patient's readiness to adopt self-management practices. Additionally, the study will evaluate the importance of patient and provider discordant pain assessment, as well as discrepancies between providers, in affecting interdisciplinary pain care.

To this end, the following sections will review relevant literature about chronic pain management, with a particular focus on the importance of pain assessment and causal pain attributions. First, a brief history of interdisciplinary care and its relevance to chronic pain treatment will be presented. This will include discussing important implementation barriers interdisciplinary treatment faces in primary care settings and its relevance to chronic pain assessment. This will be followed by a discussion of important chronic pain domains that are important to assess in a comprehensive evaluation. Particular attention will be given to specific social cognitive processes that influence the assessment process, pointing to the fact that both patients and physicians are subject to cognitive biases that influence their evaluation of chronic pain. The common sense model of illness perception will be introduced as a conceptual model to understand how patients make casual attributions regarding their chronic pain experience. Once these points are discussed a brief rationale for the current study will be provided with accompanying hypotheses.

The Evolution of Chronic Pain Treatment and Interdisciplinary Pain Management

Despite centuries of searching to understand the fundamental nature of chronic pain and how to alleviate pain related suffering, the field still struggles to find relief for many individuals. Most patients will only experience modest improvement (Turk et al., 2011). While the natural course for many individuals is to experience a slight reduction in pain intensity in the months following pain onset, over the course of a year pain levels tend to remain consistent, with patients experiencing little relief (Vasseljen, Woodhouse, Bjorngaard, & Leivseth, 2013). The World Health Organization (WHO) estimated across 14 countries in over 3,000 primary care patients with persistent pain that only 49 % of patients experienced resolution over a 12-month period (Gureje, Simon, & Korff, 2001). Similarly, other prospective studies of primary care patients show that 52% of patients exhibit poor clinical outcomes over a six-month (Foster et al., 2008) and six-year period (Kaptein et al., 2010). The details of prevalence and course of pain symptoms will vary depending on the specific type of chronic pain experienced, however these difficulties in treating chronic pain are consistent across a wide range of conditions (Institute of Medicine, 2011) and have been consistently difficult to treat even from our earliest conceptualization of pain and pain management.

The Biomedical Model and Medical Interventions. The biomedical model of chronic pain is one of the earliest conceptualizations of pain and has been the most influential in the Western approach to pain management. Being heavily influenced by Rene Descartes' specificity theory, the biomedical model assumes pain is the result of tissue damage that activates pain receptors in the periphery and sends signals via nerves that travel directly from the site of injury, through a spinal gate, and to the brain

(Melzack, 1993). Since the mind and body were thought to be dual systems, pain was solely the result of nociceptor activity. This led doctors to treat pain, up through the 1950's, largely with neurosurgical lesions to eliminate the pain signaling pathways (Melzack, 1993). Modern surgical approaches (e.g., nerve blocks, spinal injections, disc decompression, spinal cord stimulation, and intrathecal infusion) that silence nociceptive signaling without the use of lesions have shown to produce modest pain relief for some patients (Deyo, Nachemson, Mirza, 2004; Taylor, Van Buyten, & Buchser, 2005) but given their invasive nature most physicians will consider their use only after others have proven insufficient to relieve pain.

Also consistent with a biomedical model of pain management is the use of analgesic drugs. These pharmacological agents are considered first-line interventions for chronic pain, however a large majority of patients do not find significant relief using these medicines (Reid et al., 2011; Turk, 2002). Studies show that patients with chronic pain are frequently prescribed opiates, with rates as high as 75% (Clark, 2002). Opiates have shown to reduce pain by only about 30-40% for less than half of patients (Turk, 2002) and have questionable outcomes for primary care patients (Ashworth, Green, Dunn, & Jordan, 2013; Clark, 2002). Long-term use is concerning to many given the high abuse potential opiates pose as well as adverse events such as opioid induced hyperalgesia (Brush, 2012), hormonal and immunosuppressive effects (Ballantyne & Mao, 2013), and overall mortality (Bohnert et al., 2011; Chou et al., 2009). Despite the significant concerns about effectiveness and safety, the American Pain Society's clinical guidelines support the use of chronic opioid therapy with a select group of patients who are closely monitored by their physician (Chou et al., 2009). This monitoring should

include assessment of a patients risk for opioid abuse, evaluating co-morbid drug use, and checking prescription monitoring program databases.

Use of opiates can be a source of tension in the patient-physician relationship. Given the prevalence of the biomedical model in society and its focus on nociception, patients commonly expect analgesic drugs for chronic pain management. When patients are not provided these drugs they may feel unfairly treated and stigmatized as "drug seeking." Differing perceptions between patients and providers about a patient's risk for opioid abuse could provide important information about how to help patients and physicians communicate about this important treatment issue.

Biopsychosocial Model and Psychological Interventions. Although the biomedical model dominated pain management for decades, it is now recognized that a biopsychosocial conceptualization is more accurate. Melzack and Wall's (1965) conceptualization of the gate control theory was the first formalized attempt to move away from the biomedical model and account for a more complex pain experience. The gate control theory posits the existence of a "gate" in the dorsal horn of the spinal cord that modulates pain communication by integrating peripheral afferent nerve signals and efferent communication originating from the cortex, thus indicating the importance of a person's psychological experience. Additionally, Fordyce's (1976) operant framework conceptualized pain as a behavior that was amenable to learning and environmental contingencies. Thus, pain sufferers can evoke support and affection from individuals in their environment to reinforce avoidant behaviors that can perpetuate their pain. These psychological theories paved the way for what the field considers the guiding model of treatment for chronic pain—the biopsychosocial model (Gatchel et al., 2007).

While there are a variety of psychological treatments available, the most commonly employed are cognitive-behavioral therapy (CBT) approaches (Kerns, Sellinger, & Goodin, 2011; Turk, Wilson, & Cahana, 2011). These treatment approaches acknowledge the importance of cognitive, behavioral, and affective factors in the onset and maintenance of pain. The goal is to help the patient adjust and develop a sense of control over their pain (Turk, 2003). Cognitive-behavioral interventions are comprised of three general components (Keefe, 1996). First patients are provided education about the nature of pain to help begin to align the patient to taking a self-management approach. This is followed by teaching specific coping skills that can involve relaxation, distraction, or learning to challenge automatic negative thoughts. The final phase of CBT for chronic pain is an experimental and maintenance phase (Keefe, 1996). These strategies encourage patients to practice coping skills and address problem-solving issues with a therapist. Overall, meta-analyses and systematic reviews reveal small to moderate effects for the use of psychological interventions, particularly CBT, for chronic pain (Ehde, Dillworth, & Turner, 2014). Specifically, psychological interventions have shown to help reduce pain intensity, increase functional outcomes, and generally reduce psychological distress (Kerns et al., 2011; Turk, Swanson, & Tunks, 2008).

Despite the usefulness of the biopsychosocial approach and CBT treatments for pain, it is common for providers to have difficulty getting patients to invest in these needed forms of treatment. Little is understood about how to promote patient engagement in chronic pain management (Ehde et al., 2014) and given that most patients will continue to experience at least some pain following treatment, helping them learn self-management strategies is key to long-term success (Turk et al., 2008). Evaluating

patients' readiness to adopt self-management practices is considered an important step in improving pain care (Kratz et al., 2011). This motivation or openness to behavioral forms of treatment for chronic pain is likely also influenced by patients' fundamental beliefs about the cause of their pain. Thus, both motivation and patients' causal attributions are important to evaluate when seeking to implement biopsychosocial interventions.

Interdisciplinary Pain Management and Primary Care. The biopsychosocial framework to chronic pain laid the foundation for the birth of interdisciplinary pain management. John Bonica at the University of Washington was the first to establish a formal interdisciplinary clinic (Bonica, 1977). Troubled by the state of pain care at the time Bonica adopted a true biopsychosocial model that included the integration of multiple professions all with specialty training in pain management. This included physicians, psychologists, physical therapists, occupational therapists, nurses, and pharmacists providing unified care for the patient. Interdisciplinary services require frequent communication between providers all housed within the same facility to coordinate care (Gatchel et al., 2014). This suggests that all providers value the services offered by each health care professional and respect the unique contribution each makes to the management of a patient's chronic pain. This requires all team members to regularly assess the patient, communicate with other providers, and attend team meetings to discuss patient progress. Despite frequent confusion in the literature over the distinctions between multidisciplinary and interdisciplinary, true interdisciplinary care is distinct in its level and ease of communication among providers who are working as a team, rather than providing individual services (see Gatchel et al., 2014).

10

The effectiveness of interdisciplinary programs for patients with chronic pain has been well established. Interdisciplinary pain programs are superior to no treatment, wait-list groups, and single modality medical treatments (e.g., medical care, physical therapy; Flor, Fydrich, & Turk, 1992). Specifically, interdisciplinary programs result in decreased pain, improved mood, greater functional restoration, lower health care utilization, and higher return to work ratings (Flor et al., 1992; Gatchel & Okifuji, 2006). Critics suggest that interdisciplinary pain clinics are too costly, however these claims are the result of shortsighted cost evaluations (Gatchel et al., 2014). Gatchel and Okifuji (2006) provide compelling evidence that interdisciplinary treatment provides the most cost-effective treatment for patients with chronic pain, even compared to common surgical procedures (after costs associated with health care utilization, legal cases, taxes, and general economic factors like loss of productivity are taken into account).

Despite this evidence, the growth and implementation of interdisciplinary pain clinics have declined over time. Due to compensation systems that are not supportive of specialty pain care (see ACA; 2010; Gatchel et al., 2014) and a general push towards patient-centered medical homes (Davis et al., 2011; Jacobson & Jazowski, 2011) pain experts are looking to primary care settings to implement interdisciplinary interventions. Primary care clinics are well suited to meet the long-term needs of chronic pain patients (Gatchel et al., 2014), more so than short-term pain clinics.

Evidence for the use of interdisciplinary services for chronic pain in primary care is just beginning to emerge, providing promising evidence for their usefulness. First, it must be acknowledged that chronic pain populations in primary care are heterogeneous and experience a wide range of co-morbidities (Smith & Torrance, 2011), making

comparison of studies difficult. However, individual studies have found long-term (1-3 years) benefits of interdisciplinary primary care programs including lower health care utilization, reduction in risk of using high dose medications, and reduced pain intensity, disability, and depression while increasing patients' quality of life (Lamb et al., 2010; Westman et al., 2010). Overall, interdisciplinary services are thought to be beneficial in primary care settings because they can help reduce provider burden, improve patient care, and provide a model that can be applied to multiple chronic diseases where pain is featured (Debar et al., 2012).

Traditionally, primary care physicians have been reluctant to provide chronic pain management. This hesitance is largely the result of limited training (Vijayaraghavan et al., 2012) and lack of time (Barry et al., 2010; Green, Wheeler, Marchant, LaPorte, & Guerrero, 2001; Upshur, Luckmann, & Savagueau, 2006). Medical providers report having "insufficient" training (Upshur et al., 2006) with one study showing 30 % had received no formal training (Green et al., 2001). Interdisciplinary services are designed to address some of these concerns. Although an interdisciplinary approach requires regular training and team meetings that can be burdensome for busy clinics and overloaded staff (Glasgow et al., 2003), it also helps alleviate physician burden because clinical load and decision-making is distributed among team members. However, having multiple providers involved in the process of chronic pain assessment and treatment raises additional concerns that have not been investigated. Particularly, chronic pain assessment is not an objective and bias-free process (discussed below); thus interdisciplinary care could complicate the assessment process and lead to greater discrepancies between patients' and providers' perceptions of the patients' pain experience.

12

To summarize, the field has significantly improved its understanding and treatment of chronic pain over the last several decades. Moving away from a focus on nociception to a more comprehensive biopsychosocial approach is appropriate, but also has its challenges. Interdisciplinary management is the most appropriate approach to address chronic pain treatment, however with more "cooks in the kitchen" there is the possibility of complicating care, particularly when we consider how chronic pain is assessed. The unique opportunities that interdisciplinary primary care offers for chronic pain warrant further investigation. Specifically, it is important to understand how different providers on the interdisciplinary team gather and evaluate a patient's pain. Potential discrepancies between providers might hinder treatment.

Chronic Pain Assessment

Elementary to the process of implementation and dissemination of interdisciplinary chronic pain treatment are the processes and procedures by which patients and providers assess chronic pain. Pain assessment is complex due to the inherent subjectivity of the pain experience, thus making self-report the "gold standard" (Dworkin et al., 2005; Katz & Melzack, 1999). This often makes clinical decision-making difficult since physicians tend to rely more on objective diagnostic data (e.g., x-ray, lab samples) to guide their treatment planning (Gvozdenovic et al., 2014; Khan et al., 2012; Studenic, Radner, Smolen, & Aleaha, 2012; Yen et al., 2003) and currently there are no well validated objective diagnostic pain measures. Chronic pain assessment is also complicated by evidence that objective diagnostic findings only modestly correlate with patients' pain intensity reports (Dansie & Turk, 2013; Mao, 2009) and patients can report intense pain in the absence of any diagnostic data (Beattie & Meyers, 1998; Jensen &

Karoly, 2011). Despite efforts to quantify an objective pain thermometer through neuorimaging techniques (Wagner et al., 2013) it is unlikely these tools will have broad reach in clinical practice. Thus, the approach currently agreed upon is a multidimensional assessment of chronic pain (Dansie & Turk, 2013).

Assessment of the biopsychosocial nature of pain encompasses much more than unidimensional pain intensity ratings. The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) was organized in 2002 to develop an international team of experts tasked to help reconceptualize how researchers measure pain. The IMMPACT team recommends six core domains to measure when assessing chronic pain: pain intensity, physical functioning, emotional functioning, participant ratings of improvement and satisfaction with treatment, symptoms and adverse events, and participant disposition (Turk et al., 2003). In line with the IMMPACT recommendations, the following sections outline specific domains of chronic pain functioning that are important sources of information in clinical practice.

Pain Intensity. The severity of an individual's pain has been the dominant metric for evaluating pain for decades. Since we do not have an objective way to read the intensity of an individual's pain, clinicians are reliant on the patient to report this information. Among patient-reporting tools, the most commonly used to assess pain intensity are single-item numeric rating scales (NRS), verbal rating scales (VRS), and visual analog scales (VAS). These measures estimate a patient's perceived pain intensity, with subtle differences in presentation format, and have generally been shown to strongly correlate with each other (Jensen & Karoly, 2011). Their differences have led to the adoption of the VAS as the most commonly used tool to assess outcomes in pain clinical

trials (Litcher-Kelly, Martino, Broderick, & Stone, 2007) whereas NRSs and VRSs are more commonly used in clinical practice (Breivik et al., 2008; Glajchen, 2001). All three are sensitive to changes in pain intensity during treatment (Jensen & Karoly, 2011; Katz & Melzack, 1999) with some evidence to suggest the NRS is more responsive than the VAS or VRS (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). While all three can be administered quickly, the NRS is typically considered the easiest and is the instrument most commonly used in clinical practice because it does not require any specific materials (i.e., items can be presented verbally) and is easy for patients to understand (Jensen & Karoly, 2011; Katz & Melzack, 1999).

   Pain-Related Interference. Pain-related functional interference has been another widely assessed domain for chronic pain patients. A majority of patients with chronic pain face limitations in performing activities on a regular basis, and there has been a prevailing assumption that the interference was largely a result of a patient's pain intensity. However, contrary to this thinking we know that pain intensity and physical functioning only exhibit modest correlations (see Turk, 2002), thus making it an important variable to assess in addition to pain intensity. Additionally, since people with chronic pain will not generally experience complete pain relief, treatment goals generally focus to help individuals increase their functioning. Patients also report functional restoration to be among their top priorities in treatment (Casarett, Karlawish, Sankar, Hirschman, & Asch, 2001), including helping them return to work, improve their sleep, carry out basic chores, engage in recreation, and generally reach a higher level of physical activity, among others (Turk et al., 2003).

These functional goals represent a large part of a patient's health-related quality of life and have important implications for their physical and mental well-being. Being limited in ability to move and engage in regular routines is stress inducing. Particularly, patients with chronic pain in primary care settings have shown high associations between physical impairments, anxiety, and quality of life (Kroenke et al., 2013). These difficulties directly and indirectly influence a patient's ability to sleep. Pain can delay sleep onset (Kelly, Blake, Power, O'Keeffe & Fullen, 2011) and significant sleep deprivation leads to hyperalgesia (Brand, Gerber, Pühse, Holsboer-Trachsler, 2010; Onen, Alloui, Gross, Eschallier, & Dubray, 2001). Additionally, constant pain limits patients' physical and emotional resources to perform at work, with many unable to maintain employment in the short-term or long-term. However, evidence suggests that pain-related interference is responsive to treatment, with interdisciplinary treatment programs helping up to two-thirds of patients with chronic pain return to work (Vowles, Gross, Sorrell, 2004).

Depression. Evaluating a chronic pain patient's mood is another vital domain of pain assessment to consider. Depression is highly prevalent in medical settings and is estimated to occur in 5% and 10% of primary care patients (Katon & Schulberg, 1992). However, chronic pain patients are particularly vulnerable to experiencing depressive symptoms, with 27% of patients with chronic pain in primary care settings also experiencing major depression (Bair, Robinson, Katon, & Kroenke, 2003). One explanation for this high co-morbidity is due to the bidirectional association between pain and depression. A longitudinal, multinational study found that one of the strongest predictors of pain development was baseline depressive symptoms and that baseline pain

symptoms predicted the development of depressive symptoms (Gureje et al., 2001). This is thought to be at least partly the result of biological mechanisms pain and depressive symptoms share—involving the periaqueductal gray and related systems (Bair et al., 2003). This is all consistent with the biopsychosocial understanding of pain.

Given the biological and affective similarities between chronic pain and depression, it is not surprising that when patients experience these conditions simultaneously it has deleterious effects on their functioning and perceptions of their pain symptoms. As discussed above, patients with chronic pain have high rates of disability days. However, patients with co-morbid depression have shown to have even higher rates of missed-work days, with one estimate showing that within the previous three months, patients with depression and chronic pain had an average of 38 missed days (Bair, Wu, Damush, Sutherland, & Kroenke, 2008). Depression also influences how patients perceive their symptoms. An attentional bias to negative information is common in depression (Katon, 2011) and has harmful implications for patients with chronic pain. Researchers have been searching for attentional factors that influence pain perception for decades and have consistently found that negative interpretations (i.e., catastrophizing) make it more difficult for patients to shift their attention away from pain (Van Damme, Crombez, & Eccleston, 2004). When patients experience particularly intense pain it is known to elicit fearful thinking and is associated with decreased well-being (Crombez, Viane, Eccleson, Devulder, & Goubert, 2013). What is particularly interesting is that patients who experience depression and chronic pain are more likely to attribute the cause of their pain symptoms to psychological and stress related factors (Hiller et al., 2010).

Overall, depression influences the way patients fundamentally think about their pain and process pain related information.

Depression not only impacts a patient's functioning, it also influences how providers assess and treat patients with chronic pain. Evidence suggests that patients who have co-morbid pain and depression are less likely to receive adequate treatment for their depression (Bair et al., 2003), such that it is underdiagnosed and treated less aggressively. While this is likely caused by many factors, one major reason is that patients present their symptoms to their provider in a different manner, particularly reporting more of the pervasive pain symptoms than the symptoms related to mood and dysphoria (Bair et al., 2003). Overall, the presence of depression is associated with worse clinical outcomes and prognosis for patients with chronic pain (Bair et al., 2003), but there is promising evidence that treating depressive symptoms in chronic pain patients can lead to decreases in pain, pain-related impairment, and increased quality of life (Lin et al., 2003). Thus, if co-morbid depression influences both patients' and providers' attributions about the underlying nature of the patients' experience, it is important to further evaluate how these factors influence specific outcomes in interdisciplinary settings.

Opioid Risk. Opioid analgesics are one of the most commonly prescribed drugs for pain management. They account for 10.1% of all adult drug prescriptions (Gu, Dillon, & Burt, 2010) and have been steadily increasing over the last decade (Compton & Volkow, 2005). The Centers for Disease Control and Prevention (CDC) estimate a 10-fold increase in the medical use of opioids over the last 20 years (CDC, 2011). While opioids are often a necessary component of effective pain management they also pose a significant risk for abuse and mortality.

Abuse of opioids involves a pattern of hazardous behaviors wherein patients obtain and consume dangerous amounts of the drug. A review of over 60 studies found that among patients who are receiving long-term opioid therapy 3% developed opioid use disorders and 12% displayed aberrant behaviors (Fishbain, Cole, Lewis, Rosomoff, & Rosomoff, 2008). Similarly, there is evidence that 50% of patients who received an opioid prescription in 2009 had filled an opioid prescription from another provider within the previous 30 days (NIH & NIDA, 2011). Additionally, for patients who receive prescription opioids the death rate due to overdose has increased by four-fold from 1999 to 2008 (CDC, 2011). Opioid related deaths now outnumber deaths from cocaine and heroin overdose combined (Paulozzi, Weisler, & Patkar, 2011).

These trends have given clinicians reason to be more cautious in their evaluation of chronic pain and subsequent prescription of opioids. This concern is reflected in reports indicating that 29% of primary care doctors prescribe opioids less than they consider appropriate for fear of possible legal and ethical repercussions (Breuer, Cruciani, & Portenoy, 2010). However, this leads us to consider how providers identify individuals who are possibly vulnerable for opioid misuse. Overall, evidence suggests that health care professionals are not always accurate in their clinical decisions about patients who are at risk of opioid abuse (Cheatle et al., 2013). One investigation found that in a sample of chronic pain patients where 49% displayed abusive behaviors, providers only identified 13.9% of the patients with risky aberrant behaviors (Wasan et al., 2007).

Given the evidence presented above, opioid risk is an important factor to evaluate in clinical evaluations of chronic pain. Since opioid misuse is a constant concern in

chronic pain samples and providers are not always accurate in their clinical judgments, this suggests a need for more formal evaluation of patients' risk factors. Initial screening needs to be performed before patients start an opioid regimen, with frequent monitoring thereafter to monitor adherence and possible negative reactions (Chou et al., 2009).

Treatment Readiness. In the context of chronic pain management, treatment readiness refers to a patient's attitude toward engaging in self-management practices, a key component of comprehensive chronic pain treatment. This thinking involves the patients' attitudes towards the whole spectrum of treatment options for pain management (e.g., opioids and CBT), however it is of particular concern for behavioral management given the difficulty physicians have getting patients to regularly attend visits with behavioral specialists. Since, as previously discussed, interdisciplinary interventions are the most effective treatment for patients with chronic pain treatment readiness appears to be a potential barrier to successful implementation of these programs and is likely influenced by patients' perceptions about their pain.

Theorizing about a patient's readiness to adopt self-management practices has been guided by Jensen, Nielson, and Kerns' (2003) motivational model of pain self-management (MMPSM). Rooted in the transtheoretical model of behavior change (Prochaska & DiClemente, 1984), the MMPSM conceptualizes readiness to self-manage pain as both a patient's interest in and preparedness to make adaptive behavior changes. In accordance with the transtheoretical model, behavior change occurs in five stages: precontemplation, contemplation, preparation, action, and maintenance. Although Prochaska and DiClemente (1984) theorized that individuals progressed linearly through these stages, Jensen and colleagues (2003) argue that behavior change is a continuous

variable rather than progressing through discrete stages. Patients move along this continuum (i.e., change in their readiness to adopt self-management practices) based on important information (e.g., history, costs, benefits) and beliefs such as self-efficacy. This model has been shown to accurately predict multiple sclerosis pain coping behaviors (Kratz, Molton, Jensen, Ehde, & Nielson, 2011) and spinal cord injury patients' exercise behavior (Molton, Jensen, Nielson, Cardenas, & Ehde, 2008). Thus, providers can intervene to influence the patient's readiness to change by increasing the patient's efficacy towards engaging in the behavior or increasing the perceived importance of the specific coping action (Jensen et al., 2003). Additionally, fostering a collaborative patient-provider relationship can increase patient engagement. When patients and providers can communicate openly about treatment goals and concerns patient engagement in self-management practices increases (Dorflinger, Kerns, & Auerbach, 2013).

Readiness to adopt self-management techniques is still a relatively new concept in clinical application. A variety of measures have been developed (discussed below) to capture the construct and have been shown to be associated with patient's coping behaviors and clinical outcomes. Specifically, movement along the readiness continuum (e.g., precontemplation to action) reduces depressive symptoms and decreases pain intensity at 6-month follow-up (Jensen et al., 2004). Given the central importance of self-management strategies in interdisciplinary chronic pain treatment this construct has been highlighted as an important factor in improving chronic pain treatment (Kratz et al., 2011) and could help improve the implementation of interdisciplinary interventions.

Additionally, the MMPSM posits that readiness to adopt self-management practices is influenced by a patient's perceptions, making it an important area for research.

Overall, the domains of pain intensity, pain interference, depression, opioid risk, and treatment readiness are important factors to evaluate when assessing chronic pain. However, assessment of these domains is complicated by discrepancies in appraisals between patients and providers. Consistent evidence shows that pain intensity measurement varies between patients and providers. Indeed, the stability of pain intensity measurement is low between raters (Mao, 2009) and is particularly problematic when considering patients with chronic pain. Providers tend to disagree with patients' pain intensity ratings and patient-provider discrepancies are negatively associated with clinical outcomes, such that higher discrepancies predict worse functioning (Panda et al., 2006). While the effects of patient-provider discordance is well documented for pain intensity ratings, less is understood about the possible influence of patient-provider discrepancies on pain interference, depression, and opioid risk. Additionally, provider-provider discordance in these pain domains has yet to be evaluated in the literature.

Social Cognition and Patient-Provider Discrepancy

Pain assessment is a social transaction (Schiavenato & Craig, 2010) and it is recognized that cognitive bias and heuristics influence assessment in health care settings. This is particularly salient for patients with chronic pain since correlations between subjective self-reporting of pain and objective medical results are low (Dansie & Turk, 2013; Mao, 2009). Therefore some suggest that diagnostic information is often of minimal value in guiding treatment for chronic pain patients (Tait, 2013). Under these circumstances where pain is persistent and there are few objective data from which to

draw hypotheses, it is natural for providers to draw upon their clinical expertise to guide them in diagnosis and treatment decision-making. It should not be surprising then that both patients and physicians use cognitive heuristics and biases to make decisions in the clinical encounter.

The field of social cognition posits a two-system view of decision-making (Kahneman, 2003; Tait, Chibnall, & Kalauokalani, 2009) that can help us understand potential discrepancies in the pain assessment process. System 1 is labeled intuition and system 2 is labeled reasoning (Stanovich & West, 2000). System 1 is characterized as a fast, automatic, effortless, implicit, and emotional process (Kahneman, 2003). This system relies heavily on past experience and is functional because it helps us make quick decisions while taking up little mental energy. System 1's intuitive approach to processing, while economical and often efficient, leads individuals to use cognitive heuristics and biases. Conversely, System 2 is described as slow, serial, effortful, explicit, and logical (Kahneman, 2003). Governed by rules and logic, system 2 allows individuals to think purposefully and solve problems with available data. However, people are thought to operate as "cognitive misers" (Fiske & Taylor, 1991) and rely heavily on system 1, especially under conditions of uncertainty and stress (Kahneman, 2003; Tait, et al., 2009). Medical professionals are no exception to this, especially considering the busy environment and multiple demands providers must manage (Taylor, 2011). Chronic pain in many ways has become a stigmatizing condition. Primary care physicians and residents largely consider working with these patients to be difficult and have developed negative attitudes towards treating chronic pain (Chen et al., 2007; Matthias et al., 2010). Providers with these negative attitudes will be even more susceptible to cognitive bias.

Evidence suggests providers tend to disregard patients' pain reports. This is particularly problematic when patients report extreme levels of pain (Bridwell et al., 1993). In primary care settings 50% of physicians have been found to disagree with their patients' pain self-reports, with discrepancies being associated with worse physical functioning and bodily pain (Panda et al., 2006). Given that the assessment process largely relies on information that is considered fraught with uncertainty (i.e., reliance on self-report), this opens the doors for physicians to question the validity of a patient's pain experience (Tait & Chibnall, 2014). Evidence indicating bias and discrepancies in reporting has been found in both experimental as well as clinical settings. Lay observers shown vignettes of pain patients are more likely to discount patients' pain reports when there is no clear medical evidence to support them (De Rudder, Goubert, Stevens, Williams, & Crombez, 2013; De Rudder, Goubert, Vervoort, Prkachin, & Crombez, 2012). These studies also indicate that when there is sparse diagnostic medical evidence individuals feel less inclined to help a patient and more inclined to view them as deceptive (De Rudder et al., 2013; De Rudder et al., 2012). Similarly, when providers are asked to make diagnostic and clinical decisions from detailed case vignettes results consistently indicate that providers' judgments of pain are inconsistent, with one investigation finding inter-physician reliability to be essentially zero (Chibnall, Dabney, & Tait, 2000).

In addition to discounting patients' reports of pain, medical providers are also known to frequently underestimate patients' pain reports (Duignan & Dunn, 2008; Puntillo, Neighbor, O'Niel, & Nixon, 2003), with primary care professionals underestimating patients' pain ratings between 25% and 39% of office visits (Shugarman

et al., 2010; Staton et al., 2007). This evidence suggests that, when available, providers will focus their decision-making on objective clinical measurements whereas patients look to their own experience to guide assessment. Given that medical professionals' training is focused on understanding these clinical tools to guide treatment planning, this is no surprise. However, the cognitive short cuts that can lead to inaccurate decision-making are problematic in chronic pain assessment given its subjective, complex, and multidimensional nature.

These patterns of discordant pain assessment between patients and providers raise the question about what sources of information influence the assessment process. Evidence suggests that patients with chronic pain and their physicians each draw from different sources of information to guide their assessment. When evaluating patients' pain providers can anchor to their own initial perceptions of the patient's pain, even after receiving the patient's own self-report (Riva, Rusconi, Montali, & Cherubini, 2011). This supports evidence suggesting that patients' self-reports of pain are not key factors in providers' treatment decision-making (Chibnall, Dabney, & Tait, 2000). One problem could be that a majority of patients tend to use affective and broader quality of life domains as indicators of pain severity and impairment, whereas less than 20% of providers agree that affective dimensions of pain influence their own decision-making in treatment (Brown, 2004; Brown, 2005). Similarly, patients with rheumatic disease place more emphasis on their own subjective experience as a means to determine disease activity level (i.e., pain, psychological distress, fatigue), while physicians rely on objective disease-specific clinical measures (i.e., swollen joint count, erythrocyte sedimentation rate; Gvozdenovic et al., 2014; Khan et al., 2012; Studenic et al., 2012;

Yen et al., 2003). This is consistent with evidence from primary care settings that the correlation between chronic pain patients' pain intensity ratings and those of their providers is fairly low ($\rho = .2$), with patients who report severe pain having the greatest discordance with their provider (Mantyselka, Kumpusalo, Ahonen, & Takala, 2001). Thus, the types of information patients and providers attend to are different and likely result in discrepancies in evaluations of pain severity and treatment outcomes.

Overall, social cognitive processing theory suggests the need for a broader approach to accurately assess chronic pain. A patient's pain experience cannot be understood in isolation, and the assessment process inherently involves two or more individuals communicating to come to a common understanding about the patients' pain. However, as mentioned above, chronic pain patients and providers often disagree when it comes to assessing their pain. These discrepancies are known to influence clinical outcomes, such that patients' physical functioning, bodily pain, and overall health status is negatively associated with higher levels of patient-provider discrepancy in pain intensity reports (Panda et al., 2006; Shugarman et al., 2010). This could be the result of discrepancies in how patients and providers fundamentally assess the cause of a patient's chronic pain. The common-sense model (Leventhal, Meyer, & Nerenz, 1980) provides us a useful structure to understand these patient specific beliefs.

The Common-Sense Model of Illness Representation

In the process of being diagnosed and learning to manage an illness individuals develop cognitive models of disease to make sense of their symptoms and properly align resources for coping (Weinman, Petrie, Moss-Morris, & Horne, 1996). The leading framework for conceptualizing this process of illness representation has been

spearheaded by Howard Leventhal (Leventhal et al., 1980). It has been referred to as the

illness perception or representation model, the self-regulatory model, the parallel process

model, and is generally referred to as the common-sense model of self-regulation (Hale,

Treharne, & Kitas, 2007). However they all describe Leventhal's decades long work

outlining the cognitive, behavioral, affective, and social processes that comprise

individuals' ability to represent illness and self-regulate their subsequent responses to

disease threats. Overall, the model can be broken down into four overarching

components: receiving illness stimuli, forming illness representations, illness

representations influence on coping procedures, and the subsequent consequences of

coping.

The first component of the common-sense model entails receiving illness- related

stimuli. This phase of interpretation involves receiving three main sources of information

(Leventhal et al., 1980). Interpretation of illness stimuli is first guided by an unconscious

gathering of "lay" information involving the retrieval of memories related to one's own

history, social communication, and cultural understanding of a specific symptom. The

second source of information is obtained from the external environment including family,

doctors, and other medical experts. The last source of information is derived from the

individual's current experience with the illness (Hagger & Orbell, 2003; Leventhal, et al.,

1980). Together, this information forms the foundation of how a patient cognitively and

emotionally represents their illness.

The second component of the common-sense model involves synthesizing

information and forming illness representations. The illness stimuli previously gathered

help individuals form representations in a two-level process. Leventhal et al. (1980)

suggested that illness representation followed a parallel response model, such that cognitive and emotional systems process illness related information separately. Cognitive representations of illness identity and chronicity function separately from emotional representations and have different outcome consequences (Hagger & Orbell, 2003). This distinction between emotional and cognitive systems was supported by Leventhal, Singer, and Jones's (1965) previous work showing that different coping outcomes were obtained between messages that presented fearful or threatening information.

The process of forming cognitive representations of illness involves five broad attributes of illness representation: disease identity, time-line, consequences, causes, and controllability (Leventhal et al., 1984). Disease identity describes patients' fundamental beliefs about the nature of the condition and the labels they associate with illness. The time-line component indicates their attributions about the duration and time-course of symptoms (e.g., chronic/acute, cyclical/episodic) while the consequences domain outlines beliefs about the severity and functional impact the disease will have on their overall well being. The cause component outlines the causal attributions patients ascribe to their illness and similarly the controllability piece describes if they believe there is a likely cure for their symptoms. Importantly, these attributes of illness representation are not thought to be purely cognitive, but encompass important emotional representations as well (Leventhal et al., 1984; Weinman et al., 1996). For example, the consequences domain likely includes potential affective responses such as anxiety and depression. Together, these content domains highlight that illness representation cannot be boiled down to a single cognitive construct and the complexity in representation has direct influence on subsequent coping behaviors.

Once illness representations are formed, the final two components of the model outlines that cognitive representations influence coping procedures and subsequent outcomes. Individuals can engage in a variety of coping procedures to alleviate symptoms, however they are always directed by a specific stimuli and its illness representation. Patients subsequently engage in an appraisal process to evaluate the outcomes of their coping behavior to influence subsequent coping. All in all, this highlights that the common-sense model is not purely linear and involves outcome appraisal feedback to inform representation and coping (Diefenbach & Leventhal, 1996).

Taken together, three central tenants guide the common-sense framework: 1. Individuals are active problem solvers who simultaneously seek and test information about the meaning of their symptoms, 2. Illness representations are the cognitive constructs that are central to guiding coping and subsequent appraisal of outcomes, and 3. Illness representations are individual to the person and may contradict medical evidence (Diefenbach & Leventhal, 1996). Illness representations are a type of cognitive schemata that guide an individual's thinking about their disease-related health care. Thus, illness representations have a functional role in determining coping procedures and are built within an inter-personal and intra-personal framework. Leventhal's work provides us with a helpful framework to examine pain related causal attributions influence on chronic pain assessment.

Empirical investigations support the usefulness of measuring the common-sense model domains and have shown consistent associations with multiple health outcomes. Primary care low-back pain patients who expect their pain to last a long time, who perceive serious consequences, and who believe they have little ability to control their

back pain are more likely to experience greater disability compared to patients who view pain as transient and that they have some level of control (Foster et al., 2008). These results are in line with a meta-analysis that found patients who perceive their illness as uncontrollable, chronic, and severe in its consequences are more likely to use avoidant coping strategies and experience worse symptoms, greater psychological distress, and impaired social functioning (Hagger & Orbell, 2003). Similarly, osteoarthritis patients' timeline, personal control, and illness coherence perceptions became more negative over a 6-year period (Kaptein et al., 2010). Kaptein and colleagues (2010) subsequently found these perceptions of their chronic pain were related to worse clinical outcomes. Other work has supported the idea that having more symptoms (identity) and less understanding of the disease (coherence) is important for psychological functioning in patients with rheumatoid arthritis (van Os, Norton, Hughes, & Chilcot, 2012).

One domain of the common-sense model that has received less attention is the concept of causal attribution. What we do know is that patients who adhere to more psychological (e.g., "stress", "my emotional state") and risk factor (e.g., "hereditary", "smoking", "alcohol") causal attributions are more likely to feel an increased sense of personal control over their pain and treatment (Moss-Morris et al., 2002). These results suggest that patients who view themselves as somewhat responsible for their chronic pain symptoms are more likely to accept self-management approaches to coping with pain. Additionally, patients who ascribe psychological causes to their illness are more likely to see their symptoms as chronic and subsequently experience greater psychological distress (Moss-Morris et al., 2002). Evidence with patients who experience medically unexplained symptoms indicates that having uncertainty about symptoms leads patients

to have more negative perceptions of their illness and subsequently leads to increased disability and mental health concerns over time (Frostholm et al., 2007). Additionally, over a two-year period, patients who perceive the cause of medical unexplained symptoms to be psychological in nature, as opposed to biological, are more likely to report low self-rated mental health and use more medical services (Frostholm et al., 2010).

Thus, causal attributions are important factors in how patients perceive their ability to manage their symptoms and are subsequently influential in a patient's actual behavior in treatment engagement. Together, with evidence from social cognition, this suggests the central importance of causal attributions in the pain assessment process. Causal attributions in some ways could be seen as social cognitive glue to help patients and providers discuss disease and illness, but it seems likely that if causal representations are discrepant between patients and providers it could lead to problems with treatment engagement, coping, and outcome appraisals.

Statement of the Problem

As a whole, far too many patients with chronic pain do not receive appropriate management of their symptoms. While this is a multifaceted problem, one basic area in need of further investigation, explored in the current study, is how patients' and providers' pain attributions influence treatment decision-making. It is recommended practice to measure a wide variety of pain-related domains of functioning (Dansie & Turk, 2013; Turk et al., 2003), however little is known about variation in how patients and providers actually attribute causal influences to chronic pain symptoms. Following the common-sense model (Leventhal et al., 1980) patients' perceptions of their illness are

31

likely to influence coping behaviors and subsequent clinical outcomes. This suggests the potential for pain causal attributions to directly influence treatment engagement and pain-related functioning. Additionally, it is common for providers' assessment of a patient's pain to disagree with the patient's self-reported pain intensity, with discordant ratings negatively impacting pain functioning. The current study evaluated whether discrepancies between patient-provider pain causal attributions have deleterious effects on a patient's pain functioning and treatment outcomes.

The current investigation also seeks to extend our understanding of the role of chronic pain discrepancies in interdisciplinary settings. Given that patient-centered interdisciplinary pain care is considered the optimal approach to managing chronic pain (Institute of Meidcine, 2011; Tait & Chibnall, 2014) interdisciplinary teams provide an opportunity to investigate inter-provider discrepancies and the influence of these discrepancies on patient care and outcomes. There appear to be no studies to date examining how pain assessment differs across interdisciplinary providers and how discrepancies between providers could impact both patient engagement in interdisciplinary services and a provider's willingness to refer a patient for such services.

Thus, the current study has two broad aims. The first is to investigate how chronic pain causal attributions influence important pain clinical outcomes. Following the IMMPACT guidelines (Turk et al., 2003) six broad domains of pain-related functioning were evaluated by participating patients and their interdisciplinary providers. The second goal of the study is to investigate the extent to which there are pain causal attribution discrepancies between patients and providers and the role these discrepancies serve in impeding or facilitating implementation of interdisciplinary pain care. As has been

outlined, discrepancies between patients and providers are common. Interdisciplinary settings provide a unique opportunity to examine potential between-provider pain causal attribution discrepancies. To this end the following hypotheses were tested:

Hypothesis 1. Based on Leventhal and colleagues' (1980) reasoning that patients' causal attributions of illness will influence clinical outcomes, it is expected that patients' chronic pain causal attributions will predict their pain-related functioning. Specifically, psychological causal attributions compared to all other forms of attribution will predict lower pain intensity, pain-related interference, risk for opioid abuse, and depression.

Hypothesis 2. Similarly, patients' chronic pain perceptions will influence their readiness for interdisciplinary services (i.e., self-management). This is based on evidence that patients who attribute their symptoms to psychological causes are more likely to feel a sense of personal control over their pain during treatment (Moss-Morris et al., 2002). Thus, it is expected that patients who perceive the cause of their pain as predominantly psychological in nature will be more ready to engage in interdisciplinary services, as evidenced by higher scores on the MPRCQ2 (discussed further below). Additionally, evidence shows that chronic pain patients who perceive having low sense of personal and treatment control are more likely to use avoidant coping strategies (Hagger & Orbell, 2003). Therefore, it is expected that patients who have a higher sense of personal and treatment control will be more prone to adopt active problem-solving coping and will show greater readiness to engage in self-management treatment. These patients who report higher readiness for self-management are expected to be more likely to attend a behavioral health consultation at 3-month follow-up.

Hypothesis 3. Given that different disciplines (e.g., internal medicine, psychology) develop their own tools for evaluating pain it is expected that ratings will not only be discrepant between patient and provider, but providers' ratings of pain functioning will also differ as a function of whether they are an internal medicine resident or a psychology behavioral medicine trainee.

Hypothesis 4. Based on findings that the magnitude of pain intensity discrepancies between patient and provider impact patient outcomes (Panda et al., 2006; Mantyselka et al., 2001) it is expected that discrepancies in other areas of pain-related functioning and etiology will affect interdisciplinary primary care pain management. Specifically, patient-provider discrepancies in ratings of causal attributions, intensity, interference, opioid risk, and depression will predict the following outcomes across all interdisciplinary providers:

- Discrepancies will be associated with the frequency of provider referrals to behavioral medicine, such that higher discrepancies will predict lower referrals at 3-month follow-up.

- Greater discrepancies will be associated with patients attending fewer behavioral health sessions over the three months following baseline assessment.

- Higher levels of discrepancies will be directly related to being on higher opioid doses at follow-up.

Hypothesis 5. Discrepancies between patient and provider are not only predicted to impact interdisciplinary care, large discrepancies between providers' ratings of patients' pain functioning are also expected to influence patient engagement. Particularly,

greater inter-provider disagreements on patients' pain functioning (i.e., causal attribution, intensity, interference, opioid risk, depression) are expected to show the same relationships as predicted in hypothesis 4: fewer referrals to behavioral medicine, fewer attended behavioral health sessions, and higher opioid dose at 3-month follow-up.

Method

Participants

Participants included 80 patients suffering from a chronic pain condition. Participants were selected from Virginia Commonwealth University Health System's (VCUHS) outpatient primary care resident training clinic. A total of 137 patients were approached to participate in the study, thus 57 declined to participate. Of those who declined participation six stated "I am in too much pain," 15 indicated they didn't have time, and the other 36 provided no explanation. The chronic pain patients were generally female (65%) and had a mean age of 55 years (range 28-79). They were largely African-American (51%) and Caucasian (45%). Most patients had more than one pain condition, with the most common pain diagnoses being musculoskeletal (61%) and osteoarthritis (34%). All patients had a documented diagnosis of chronic pain, lasting > 3 months in the electronic medical record (EMR), were 18-years or older, and spoke English. Efforts were made to limit the exposure patients had to their treating physician (i.e., no more than six months working together) and behavioral medicine service (not seen by behavioral medicine service within the last two years). However, due to low participation rates these criteria were removed and were statistically controlled for when necessary. See Table 1 for full demographic characteristics of sample.

In addition to the clinic patients, the study sample included 16 internal medicine residents and six behavioral medicine doctoral students. Participating internal medicine

residents included seven 2nd and nine 3rd year residents. Given their relative lack of

experience working with patients who have chronic pain, first year medicine interns were

not approached to participate. Behavioral medicine trainees included three 2nd year, one

3rd year, one 4th year, and one 5th year student.

Table 1.
Summary of Patient Sample Characteristics, N = 80

	n	%	*M*	*SD*	Range
Age			55.00	10.98	28-79
Gender					
Male	28	35			
Female	52	65			
Ethnicity					
African American	41	51			
Caucasian	36	45			
Hispanic	1	1			
Other	2	3			
Distance (miles)			36.99	31.67	0-161
Years in Clinic			3.62	2.56	0-7
# Sessions w Resident			2.56	3.51	0-13
On Opioids	51	65			
Oxycodone	26				
Tramadol	18				
Hydrocodone	6				
Morphine	4				
Methadone	1				
Hydromorphone	1				
Codeine	1				
Fentanyl Patch	1				
NRS			6.30	2.31	0-10
PHQ			11.22	6.81	0-27
ORT			4.89	5.16	0-23
MPI-IS			4.30	1.38	.11-6

Multiple patients were prescribed more than one opiate medication. Average number of sessions with resident was skewed by a few patients with a high visit rate, median value of 1, 67.50 % of sample had 2 or fewer visits.

Procedures

Once participating physicians and behavioral medicine trainees had been identified and provided informed consent to participate the investigator examined providers' patient panels to determine appropriate patients to approach for participation. Prior to their medical visits, the patients' charts were examined to identify those who met eligibility criteria. The investigator approached patients before or during their medical appointment to introduce the study and discuss informed consent. Specifically the investigator stated his role as part of the healthcare team in the clinic and as a researcher, discussed informed consent with the patient, described the clinic's desire to improve how it assesses patients' pain experience, and highlighted that the information they provide in this study would not enter their EMR and have no bearing on the care they receive. Patients who chose to participate were compensated $10 for participation.

Once a patient consented to participate they were provided a packet of questionnaires to complete before they left the clinic. These questionnaires assessed six broad domains of pain functioning, described below. During the patient's medical appointment and while their treating resident was consulting with their attending physician a behavioral medicine consultant stepped into the patient's room to perform a brief 5-10 minute standard behavioral medicine pain clinical interview. At the completion of the patient's appointment both the medical residents and the behavioral medicine trainees were asked to assess the same six pain domains answered by the patient. Whereas the patient survey took roughly 30 minutes to complete the provider survey was adapted to take less than 5 minutes, described further below. Patients were asked to respond to the pain-related questionnaires in the following order: illness perception

questionnaire treatment and personal control subscales, illness perception questionnaire causal attribution subscale, a numeric rating scale, patient health questionnaire – 9, opioid risk tool, brief multidimensional pain related coping questionnaire 2, multidimensional pain inventory – interference scale, a question about whether they agree with their doctor's treatment plan, a question about if they would attend behavioral medicine services, and the ten item personality inventory. Providers responded to items in a slightly different order: a numeric rating scale, illness perception questionnaire causal attribution subscale, a question about whether the patient's pain is caused by pain medication dependence, a question about whether they would recommend behavioral medicine services, overall ratings of the patient's pain related interference, depression, and risk for opioid abuse, and lastly the provider's attitudes towards treating patients with chronic pain.

To examine the impact of patient-provider assessment discrepancies as well as provider-provider discordance the investigator examined the EMR after 12 weeks to collect follow-up data. Specifically, information about the provider's referrals to behavioral medicine and other treatment specialties (e.g., ER, physical therapy) and opioid dosage was obtained. These variables can be viewed as indicators of the level of integrative care the patient was receiving and the overall quality of managing the patient's safety. Additionally, the EMR provided basic demographic information (e.g., age, gender, ethnicity, zip code, pain diagnosis, co-morbid physical and mental health diagnoses, length of care in the clinic, number of sessions the medical provider has had with patient) that was considered for use in data analyses. All study procedures were

approved by and conducted in accordance with policies set forth by the Virginia Commonwealth University Institutional Review Board.

Measures

      Pain Intensity. The most commonly used tool to measure pain intensity in clinical settings is the numeric rating scale (NRS; Breivik et al., 2008; Glajchen, 2001; Jensen & Karoly, 2011). The current study used a NRS asking patients to rate their pain "On a scale of 0 to 10, with 0 being no pain at all and 10 being the worst pain possible, how would you rate your pain right now?" Providers were given a similar prompt: "On a scale of 0 to 10, with 0 being no pain at all and 10 being the worst pain imaginable, how would you rate your patient's pain when you saw them for their medical visit?" The 11-point scale has shown similar discriminative power as the 101-point NRS for chronic pain patients when attempting to describe their pain (Jensen, Turner & Romano, 1994). Additionally, the NRS has consistently demonstrated high correlations with other pain intensity measures (Ferreira-Valente et al., 2011; Jensen et al., 1986) and is sensitive to therapeutic change (Jensen & Karoly, 2011), with some evidence suggesting it being more responsive than visual analog scales and verbal rating scales (Ferreira-Valente et al., 2011). Additionally the current investigator chose to use the NRS over a scale that has ratio scaling properties since the NRS is already a common practice in the VCUHS primary care clinic.

      Pain Interference. The Multidimensional Pain Inventory (MPI) is a 52-item measure developed for assessing multiple psychosocial domains of functioning in patients with chronic pain (Kerns, Turk, & Rudy, 1985). The MPI is comprised of 12 subscales: pain severity, interference, life control, affective distress, support, punishing

responses, solicitous responses, distracting responses, household chores, outdoor work, activities away from home, and social activities (Kerns et al., 1985). Each of the scales has demonstrated internal reliability coefficients between .70 and .90 with the 2-week test-retest temporal stability of each of the scales ranging from .62 to .91 (Kerns et al., 1985). In medical settings the MPI has been used to obtain separate scale scores or to derive one of three pain profiles (Dysfunctional, Interpersonally Distressed, and the Adaptive Coper; Turk & Rudy, 1988).

One way that researchers and clinicians have employed the MPI has been to use the items on the interference scale (MPI-IS) as a measure of pain related physical functioning (Riley, Zawacki, Robinson, & Geisser, 1999). This practice has been recommended by the IMMPACT group as standard practice for pain clinical trials based on its validity, demonstrated reliability, and relatively quick administration (Dworkin et al., 2005). The MPI-IS is comprised of nine items (e.g., "How much has your pain changed the amount of satisfaction you get from family-related activities?") that ask individuals to respond on a 7-point scale with varying anchors for the item (e.g., 0 = "No Interference", 6 = "Extreme Interference" or 0 = "No Change", 6 = "Extreme Change"). Normative data from 190 veterans with chronic pain showed an average IS score of 4.30 (SD = 1.20; U.S. Department of Veterans Affairs, 2010) with similar averages reported in unpublished norms.

In the current study patients were asked to respond to all nine items of the MPI-IS as well as give an overall categorical rating of their level of pain-related interference (i.e., none, low, moderate, high). Providers responded to the following question: "What is your patient's current level of pain-related physical interference?" with responses being none,

41

low, moderate, or high. Providers were asked to only provide a general rating of the patient's functioning because currently there is no validated physician scored interference scale, and medical providers often would not have the information to appropriately score the MPI-IS items. The categories "none," "low," "moderate," or "high" correspond well to the scaling presented in the MPI-IS. When examining the relationship between patients' overall MPI-IS and the providers' rating only the categorical rankings were compared.

Opioid Dependence Risk. The Opioid Risk Tool (ORT) is an instrument designed to predict a patient's probability of opioid misuse when being considered for opioid therapy for chronic pain (Webster & Webster, 2005). It is comprised of five dichotomous yes/no items asking about empirically supported factors relevant in the literature: family history of substance abuse, personal history of substance abuse, age, history of sexual abuse, and specific "psychological disease[s]." Items are weighted based on an individual's gender and the specific risk factor being considered (e.g., family history of alcoholism equate to a 1 for females and 3 for males while personal history of alcoholism equate to a 3 for both genders). These weights were determined based on the developer's clinical experience and their review of relevant opioid abuse literature (Webster & Webster, 2005). The items are totaled and scores are classified as low (0-3), moderate (4-7), or high risk (≥8) for aberrant opioid-related behavior. There are two alternative forms of the ORT, one that is self-report and another that a medical provider can complete during a medical visit. Evidence suggests moderate correlations between these versions (r = .61; Witkin, Diskina, Fernandes, Farrar, & Ashburn, 2013). The ORT also has high sensitivity and specificity to discriminate those who exhibit opioid-related

aberrant behavior for both males ($c = .82$) and females ($c = .85$; Webster & Webster, 2005). The current study had patients complete the self-report version of the ORT while providers completed an overall question asking them to rate "What is your patient's current risk of opioid abuse?" on a scale of 1 (low), 2 (moderate), or 3 (high).

Depression. The Patient Health Questionnaire (PHQ) is a self-reported version of the PRIME-MD with a specific module (i.e., PHQ-9) for assessing depressive symptoms. The PHQ-9 is a brief measure of depression severity that assesses each of the nine symptom criteria for a major depressive episode in the Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSM-IV; Kroenke, Spitzer & Williams, 2001). Patients rate the presence of all nine criteria over the last two weeks from 0 = "not at all" to 3 = "nearly every day." The PHQ-9 has high estimated internal consistency (Cronbach's alpha 0.89) and scoring at least a 10 out of the total 27 points possible demonstrates sensitivity and specificity of 88% for a major depressive episode. Additionally scoring a 5, 10, 15, and 20 on the PHQ-9 represents mild, moderate, moderately severe, and severe symptoms of depression, respectively (Kroenke et al., 2001). The PHQ-9 was designed for quick administration in medical settings, especially primary care clinics, with applications to a variety of clinical populations (Alschuler et al., 2013; Milette, Hudson, Baron, & Thombs, 2010), including patients with chronic pain (Arnow et al., 2006).

In the current study patients completed the full PHQ-9 while also ranking their level of depression on the following categorical scale: none, low, moderate, or high. These categorical rankings correspond to the cut-off scores of 5, 10, 15, and 20, respectively. Providers rated their patient's overall level of depression by responding to the following item: "What is your patient's current level of depression?" They were

provided the options of none, low, moderate, or high. When comparing patients' and providers' ratings of depression only the categorical rankings were compared.

Treatment Readiness. A patient's readiness for interdisciplinary treatment was measured through the multidimensional pain readiness to change questionnaire version 2 (MPRCQ2; Nielson, Jensen, Ehde, Kerns, & Molton, 2008). The MPRCQ2 is theoretically rooted in the MMPSM, discussed above, and was an extension of the initial pain stages of change questionnaire (PSOCQ; Kerns, Rosenberg, Jamison, Caudill & Haythornthwaite, 1997). The MPRCQ2 was designed to measure a patient's readiness to adopt common coping strategies taught in interdisciplinary treatment programs (e.g., relaxation, pacing, assertive communication; Nielson, Jensen, Ehde, Kerns, & Molton, 2008; Nielson, Jensen, & Kerns, 2003). Rather than focusing on putting patients into a diagnostic box, it aims to understand how much a patient is contemplating the adoption of common pain coping techniques. This allows researchers and clinicians to obtain more nuanced information about a patient's readiness for interdisciplinary treatment. The 69-item MPRCQ2 is comprised of 9 subscales (exercise, task persistence, relaxation, cognitive control, pacing, avoiding pain contingent rest, avoid asking for assistance, assertive communication, and proper body mechanics) that load onto two overarching factors of active coping and perseverance. The MPRCQ2 has demonstrated adequate internal consistency (reliabilities range from .77-.94), had moderate correlations with criterion measures (i.e., Chronic Pain Coping Inventory and PSOCQ), and had high variability among MPRCQ2 scales (Nielson et al., 2008). Considering response burden on the MPRCQ2, two brief versions have been developed—a one item per scale measure (13-item) and one with two items per scale (26-item). The current study used the 26-item

44

MPRCQ2 given that this version has demonstrated higher correlations ($r \geq .80$) with its parent MPRCQ2 scales than the 13-item measure ($r \geq .60$) and also highly correlates with the PSOCQ (Nielson, Armstrong, Jensen, & Kerns, 2009). In addition to the evidence of the 26-item MPRCQ2s validity and reliability, it has demonstrated sensitivity to change during treatment (Nielson et al., 2009).

In addition to completing the entire 26-item MPRCQ2, patients responded to two other treatment related questions: "Do you agree with your doctor's treatment plan for your pain?" and "If given a referral to see behavioral medicine as part of your pain management, would you attend?" In an effort to reduce response burden, health care providers were not asked to evaluate patients' readiness to adopt pain self-management strategies. Rather, providers were asked to respond to the following question: "Based on your clinical evaluation, are behavioral medicine services warranted to help your patient manage their pain?"

Causal Attributions. To investigate causal attributions about a patient's pain the current study utilized the illness perception questionnaire-revised (IPQ-R; Moss-Morris et al., 2002). The IPQ-R is a generic illness measure designed to assess patients' perceptions about illness-related symptoms and is flexible to be adapted to specific health conditions. An illness-specific version of the IPQ-R has been developed for patients with chronic pain and is available at www.uib.no/ipq/. In the present study only the causal, personal control, and treatment control subscales were administered.

The causal scale contains a list of 18 common causes of illness (e.g., stress or worry, my own behavior, etc.) that measure four separate types of causal attributions: psychological, risk factor, immunity, and accident/chance. Participants then rate these

items on a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree. The four-factor structure of the IPQ-R's causal scale has demonstrated adequate temporal stability with correlations ranging between .53 and .88 (Morris et al., 2002). The validity of the IPQ-R's causal scale was also determined by comparing scale scores between a sample of chronic pain and acute pain patients. These comparisons found that patients with chronic pain scored significantly higher on all subscales of the causal attribution domain, except on the accident/chance attributions, whereas acute pain patients consistently rated this higher than chronic patients (Morris et al., 2002).

The treatment control and personal control subscales ask patients to rate items about perceptions of what influences their illness such as: "There is a lot which I can do to control my chronic pain," "My actions will have no effect on the outcome of my chronic pain," and "My treatment will be effective in curing my chronic pain." Patients rate these items on the same five-point Likert scale: 1 = strongly disagree to 5 = strongly agree. Valid and reliable use of the IPQ-R has been demonstrated with a number of chronic pain samples ranging from fibromyalgia (van Wilgen et al., 2008) to rheumatoid arthritis (Maas, Taal, van der Linden, & Boonen, 2009).

While patients completed the causal, personal, and treatment control scales of the IPQ-R, providers were asked to only complete the causal scale of the IPQ-R. The prompt was adapted to ask providers to rate the cause of "your patient's chronic pain" and omitted the statement that "We are most interested in your own views about the factors that caused your chronic pain rather than what others including doctors or family may have suggested to you" since it isn't relevant for the provider to consider.

Personality. Participants completed the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003); a brief measure designed to assess the Big Five personality domains of extraversion/introversion, agreeableness, conscientiousness, emotional stability, and openness to experience (see Goldberg, 1993). The TIPI asks participants to rate their level of agreement with ten items asking about their personality (e.g. 1. extraverted, enthusiastic 2. critical, quarrelsome) from 1 (disagree strongly) to 7 (agree strongly). Two items represent each of the Big Five personality domains and the TIPI has been shown to correlate well with the more in-depth Big-Five Inventory and NEO-PI-R (Gosling et al., 2003). In addition to the validity of the structure of the TIPI it has demonstrated adequate test-retest temporal stability ($r = .72$; Gosling et al., 2003). Aside from the initial findings in its development study the TIPI has been used in studies examining personality factors and their influence on outcomes for pain patients (Krok & Baker, 2013).

Provider Attitudes. Providers responded to an adapted version of the Medical Condition Regard Scale (MCRS; Christison, Haviland, Riggs, 2002) to assess their attitudes towards treating chronic pain patients. The MCRS is a diagnostically non-specific scale that can be adapted to any health condition. It is comprised of 11 items asking professionals to respond to statements such as "I prefer to not work with patients like this" and "I wouldn't mind getting up on call nights to care for patients like this." Responses are scored on a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree) with higher total scores indicative of more positive attitudes. The MCRS's test-retest temporal stability has been estimated at .84 and it can discriminate among attitudes towards different diagnostic groups traditionally thought to be neutral

(e.g., heartburn) and difficult (e.g., somatoform disorder) to work with (Christison et al., 2002).

The current study utilized a modified version of the MCRS to reduce response burden for the providers. Items were selected based on 1. Factor loading, 2. Content overlap, and 3. The direction of the response (i.e., positive/negative). Based on these criteria the four following items were selected: "I prefer not to work with patients like this," "Working with patients like this is satisfying," "I can usually find something that helps patients like this feel better," and "Treating patients like this is a waste of medical dollars." Providers were given the prompt "Rate the following items from the perspective of treating patients with chronic pain."

Design and Data Analyses

The current study utilized a cross-sectional design with the addition of short-term longitudinal follow-up. Patients and providers were assessed once at baseline and then EMR demographic and outcome variables were gathered at three-month follow-up. Given the inherent nested structure of the data all analyses account for the shared variance between these groupings. Hypothesis testing accounted for nesting of multiple patients within a medical resident's panel. To account for the non-independence within provider groupings robust clustered standard errors were estimated. These robust variance estimators allow the model to account for the likelihood of shared variance of patients' scores who saw the same medical resident. This method was selected over multilevel modeling given the relatively small overall sample size and more importantly the small size of the nested sample. Maas and Hox (2005) highlight that when the second level of a multilevel model has 50 or fewer observations the risk of having biased

estimations is significantly increased. The current sample had 16 participants in the second level, thus multilevel modeling was considered inappropriate for the sample under consideration.

Preliminary analyses were performed to examine the structure of the data and to obtain descriptive information. The following variables were considered for inclusion in models as covariates: demographic variables, distance patients reside from the clinic, baseline diagnosis of depression, and how long the patient had been seen in the clinic. Other possibly important covariates included personality traits such as conscientiousness because they have been shown to influence pain related behaviors and treatment engagement (Bogg & Roberts, 2004; Hill & Roberts, 2011). Providers' attitudes toward treating patients with chronic pain were also considered, given that providers hold predominantly negative attitudes towards treating chronic pain (Chen et al., 2007; Matthias et al., 2010). Correlation analysis was used to determine which variables were necessary to include as covariates. Pearson product-moment correlation was used for continuous variables and point-biserial correlations were used for determining the correlation between a dichotomous and continuous variable. A significance level of $p <$ .05 was used to determine which variables were significantly related to the specific dependent variable of the model.

Missing data values were a regular occurrence across participants. This was generally due to oversight by patients and providers completing the surveys leading to at least one missing value on a majority of the measurement tools. Additionally, there were four instances when medical residents did not return their survey. Upon further examination, missing data were found to be equally distributed across measures and

appeared to be missing at random. Multiple imputation was considered to account for missing data; however, the current sample did not have adequate size to estimate the large number of needed parameters. Thus, mean imputations were computed for measures of the IPQ-R, IPQ-R CS, PHQ, MPRCQ, and TIPI. This was performed in an effort to increase power in the analyses.

Data were appropriately examined to facilitate accurate comparison and interpretation. Causal attributions of chronic pain were scored using Morris and colleagues (2002) four-factor model. In analyses, the risk factor, immunity, and accident/chance attributions were combined into an "other" attribution score to compare against psychological attributions. Discrepancy scores were calculated separately for patients' and providers' ratings, as well as between medical residents' and behavioral medicine trainees' ratings of the same patient's functioning. For ratings on the NRS, ORT, MPI-IS, and PHQ discrepancies were determined on a categorical basis. Ratings were considered discrepant if two scores were one category apart, consistent with Kappesser, Williams, and Prkachin's (2006) ± 1 NRS criteria. However, for the IPQ-R scale discrepancies were determined by subtracting patients' subscale scores from providers' scores, as well as providers' subscale scores from those of other providers. Thus, separate discrepancy scores were calculated for each dyad and represent a continuous rating.

Following descriptive analyses each hypothesis was tested systematically. Multiple regression was utilized to test hypothesis 1: whether patients' IPQ-R causal subscale scores predicted pain functioning outcomes (pain intensity, pain interference, opioid risk, and depression). Hypothesis 2 used multiple regression to test whether IPQ-R

causal attributions, personal control, and treatment control scale totals predicted a patient's MPRCQ2 total readiness score and subsequently if MPRCQ2 scores predicted attendance at a behavioral health session. Since attendance was a binary variable logistic regression was employed. Additionally, given the small number of patients (n = 24) who were referred for services an exact logistic model was used to adjust for the small sample size. Structural equation modeling was considered for this analysis; however, a number of problems were encountered. Due to the small number of patients who were actually referred for services and the large number of items that factor into each of the latent variables (26 for the MPRCQ2) model identification and specification would have been problematic (Wolf, Harrington, Clark, & Miller, 2007). Hypothesis 3 used independent group t-tests to determine overall group differences between residents and behavioral medicine trainees on ratings of pain functioning. Last, hypotheses 4 and 5 utilized discrepancy scores as independent variables to predict clinical outcomes. Hypothesis 4 used discrepancies between patients and their providers to estimate separate regressions for discrepancies with behavioral medicine trainees and internal medicine residents. Tests of hypothesis 5 were similar, however discrepancies between providers were used as predictors. The models estimated the influence these discrepancies had on predicting the following outcomes: patients being referred for behavioral medicine services, whether or not the patient attends the behavioral medicine visit, and total opioid daily dose at baseline and at follow-up. Due to the binary nature of these outcome variables multivariate and exact logistic regression were used to estimate these models. All analyses were conducted using Stata 11.2 (StataCorp, 2009).

Results

Hypotheses were tested sequentially. Given the unique nature of each analytical approach, data were checked, transformed, and treated based on the specific analysis employed. Each section below will address specific strategies used to check that analytical assumptions were met prior to analysis and that data were appropriately treated to facilitate interpretation.

Hypothesis 1

Hierarchical multiple regression was used to examine patients' chronic pain causal attribution's influence on pain-related functional outcomes. Separate regression models were run for each outcome of interest: NRS, PHQ, MPI-IS, and ORT. Assumptions of linearity, multivariate normality, and heteroskedasticity were examined prior to analysis. Firstly, heteroskedasticity is of little concern because the clustering command in the model accounts for any skewed variability, if present. Linearity of the models was tested with post-estimation regression specification-error tests. Out of the multiple hierarchical models estimated, only the univariate prediction of PHQ from patients' psychological attribution score evidenced problematic model specification. However, once additional variables and covariates were added to the model the specification error resolved. Doornick-Hansen tests of multivariate normality revealed concerns for multivariate normality. Additionally, examination of residual plots confirmed a non-random scattering of residuals against fitted values, suggesting

52

transformation of dependent variables. Models were tested with and without transforming variables by squaring NRS and MPI-IS and using the square root of PHQ and ORT. Including the transformed dependent variables did not alter the interpretation of any of the models and therefore non-transformed variables were included to aid interpretation.

Hierarchical models were estimated in a step-wise fashion (see Table 2). Step one included covariates pertinent to the outcome of interest. Four of the demographic variables were significantly related to any of the outcomes variables. Specifically, patients' scores on the PHQ were significantly correlated with the number of visits a patient had with the medical resident, $r = -0.22$, p = 0.048, the patient's age, $r = -0.25$, p = 0.028, and patients' self-reported conscientiousness, $r = -0.33$, p = 0.003. Also, having a diagnosis of depression in the EMR was positively correlated, $r_{pb} = 0.28$, p = 0.013, with patients' MPI-IS score. For models that did not have any significant demographic covariates (NRS & ORT) this first step of the model was not included. Next, patients' other attributions for their pain were added to the second step of the model. Last, step 3 included patients' psychological causal attributions about their chronic pain.

Results of the analyses indicated that patients' causal attributions about their chronic pain influenced most areas of patient pain functioning (see Table 2). The only outcome that was not significantly related to psychological or other attributions of chronic pain was patients' NRS scores. Specifically, confirming the proposed hypothesis, patients who attributed their chronic pain to more psychological causes had higher scores on the PHQ, above and beyond the influence of a patient's age, the number of visits they had in the clinic, and their self-rated level of conscientiousness. Aside from psychological attributions, patients having higher levels of all other causal attributions for their chronic

53

pain predicted increased risk of opioid abuse and higher levels of functional impairments.

In the model estimating attributions' impact on MPI-IS other causal attributions were

found to be predictive of functional impairment above and beyond the impact of a patient

at baseline being diagnosed with depression.

Table 2.
Multiple regression analysis testing relation between psychological causal attributions of chronic pain and patients' pain related functioning: NRS, PHQ, MPI-IS, and ORT.

Step	Variable	B	SE	95% CI	R^2	R^2 Change
DV = NRS						
1	None					
2	Otherattribution	-.008	.028	-.07, .05	.001	
3	Otherattribution	-.013	.038	-.10, .07		
	Psychattribution	.010	.065	-.13, .15	.001	.000
DV = ORT						
1	None					
2	Otherattribution	.245**	.070	.10, .39	.143	
3	Otherattribution	.310*	.131	.03, .59		
	Psychattribution	-.145	.181	-.53, .24	.153	.010
DV = PHQ						
1	Age	-.106	.093	-.30, .09		
	# Sessions w/ Resident	-.343	.167	-.70, .01		
	Conscientiousness	-1.488**	.427	-2.40, -.58	.186	
2	Age	-.107	.093	-.30, .09		
	# Sessions w/ Resident	-.339	.167	-.70, .02		
	Conscientiousness	-1.466**	.424	-2.37, -.56		
	Otherattribution	.027	.090	-.16, .22	.187	.001
3	Age	-.120	.092	-.32, .08		
	# Sessions w/ Resident	-.308	.163	-.65, .04		
	Conscientiousness	-1.272**	.399	-2.12, -.42		
	Otherattribution	-.120	.107	-.35, .11		
	Psychattribution	.324**	.107	.11, .57	.216	.029**
DV = MPI-IS						
1	Depression	.730	.345	-.01, 1.47	.063	
2	Depression	.825*	.343	.09, 1.56		
	Otherattribution	-.050**	.016	-.08, -.02	.139	.076**
3	Depression	.797*	.345	.06, 1.53		
	Otherattribution	-.060**	.019	-.10, -.02		
	Psychattribution	.023	.025	-.03, .08	.142	.003

All SEs represent robust standard errors accounting for patient's being clustered within providers.
* $p < 0.05$, ** $p < 0.01$

Post hoc analyses were performed to further understand the impact of other causal attributions of chronic pain on ORT and MPI-IS scores. Hierarchical multiple regressions were repeated in the same stepwise fashion, however the "other attributions" variable was replaced with each of the subscale scores (i.e., risk factor, immunity, and accident/chance). Results revealed that the risk factor and accident/chance attributions significantly predicted ORT scores, $B = 0.43$, $SE = 0.16$, $t(76) = 2.74$, $p < 0.05$; $B = 0.82$, $SE = 0.27$, $t(76) = 3.00$, $p < 0.01$, respectively. These variables remained significant predictors of opioid risk even after accounting for psychological causal attributions of chronic pain. Interestingly, when individual subscales of causal attributions were included in the MPI-IS model none of the variables were significant. Overall, this suggested that attributions related to risky behaviors or accidents are more predictive of a patient's risk of opioid abuse than psychological or immunity attributions. However, the results are less clear when considering causal attributions' impact on pain-related functional interference, suggesting that the average effect of these attributions might be more influential than any single attribution.

Hypothesis 2

Multiple regression was employed to determine which patient factors would predict MPRCQ scores. No concerns for colinearity or multivariate normality were found prior to analysis. Models were tested with significant covariates (i.e., the total number of sessions a patient had with the medical resident and residents' year in training). However, including these covariates produced multivariate normality problems. Model specification was optimized by omitting these covariates, thus the final model consisted

of the following predictors from the IPQ-R: psychological causal attribution score, all other causal attribution scores, treatment control subscale scores, and personal control subscale scores.

Results revealed that the model failed to explain important variance in MPRCQ total scores. The overall model was non-significant, $F(4, 15) = 1.11$, $p = 0.39$, and accounted for minimal proportion of the variance in MPRCQ total scores ($R^2 = 0.06$). Specifically, psychological and all other causal attributions of chronic pain did not significantly predict MPRCQ scores, B = -0.27, SE = 0.24, $t(71) = -1.12$, $p = 0.28$; B = -0.13, SE = 0.17, $t(71) = -0.76$, $p = 0.46$, respectively. Perceptions of personal control and treatment control also did not predict MPRCQ scores, B = 0.40, SE = 0.27, $t(71) = 1.49$, $p = 0.16$; B = 0.11, SE = 0.35, $t(71) = 0.31$, $p = 0.76$, respectively. Counter to the proposed hypotheses, the IPQ-R subscales included in the analysis were not related to subsequent pain-related coping.

To examine the MPRCQ's ability to predict attendance at behavioral medicine visits exact logistic regression was used. Standard logistic regression was considered inappropriate in this situation due to the small number of patients who were referred for behavioral medicine services (n = 24). Exact logistic regression is a type of logistic modeling that was designed for small sample data and does not depend on asymptotic large sample sizes as logistic regression does. A single model was attempted with the MPRCQ score and patients' conscientiousness score entered as predictors, however the model required too many enumerations to estimate parameters and crashed. The model successfully ran once conscientiousness was entered as a conditional variable. This meant conscientiousness was included in the model to calculate the independent effect of

MPRCQ, however parameter calculations were omitted for conscientiousness. A second model was estimated with conscientiousness being estimated as a parameter and MPRCQ being classified as conditional. Box-Tidwell regression modeling was used to test logistic assumptions of the linearity of the logit. Both exact logistic models revealed no concerns for non-linearity. Additionally, there was little concern for multicollinearity given a near zero correlation between MPRCQ and conscientiousness scores, $r = 0.006$.

Results revealed the overall model of MPRCQ and conscientiousness scores did not significantly predict whether patients who were referred for behavioral medicine services actually attended a visit. Specifically, the MPRCQ score was not significantly predictive of attendance, OR = 1.02, $p = 0.72$, 95% CI [0.91, 1.14], nor was conscientiousness, OR = 0.94, $p = 0.98$, 95% CI [0.44, 1.76] when accounting for each other in analysis. These findings were counter to the hypothesized relationships and overall suggest that patients' attendance at behavioral medicine visits was not in part due to their readiness to adopt chronic pain self-management coping techniques.

Hypothesis 3

To examine possible differences between how separate disciplines rated chronic pain functioning group means were tested. Independent group t-tests were calculated for providers' scores on the NRS, PHQ, as well as psychological attribution and other attribution scores. Providers' ratings of patients' risk for opioid abuse were skewed, $z = 2.94$, $p < .01$, and thus a Wilcox-Mann-Whitney test was used. All other variables were found to have a normal data structure.

Consistent with the proposed hypothesis, behavioral medicine students and medical residents rated patients differently across nearly all chronic pain functioning

domains. The only outcome that was not rated differently between disciplines was opioid risk, with both groups of providers giving average abuse ratings in the "low" risk range (behavioral medicine $M = 1.56$, $SD = 0.67$; medical residents $M = 1.51$, $SD = 0.64$; $z = -0.50$, $p = 0.61$). On average, behavioral medicine trainees rated patients' NRS higher ($M = 5.08$, $SD = 1.93$) than medical residents ($M = 4.16$, $SD = 3.33$), $t(152) = -2.66$, $p < 0.01$, by nearly 1 NRS unit. Regarding a patient's level of depression, behavioral medicine trainees also rated patients higher on their overall level of depression ($M = 1.49$, $SD = 0.83$), than did medical residents ($M = 1.17$, $SD = 0.81$), $t(153) = -2.39$, $p < 0.05$. Although this difference between groups was statistically significant, a difference of 0.32 has little clinical value since it is within the same categorical rating of depression (i.e., mild). Last, medical residents on average scored the IPQR-CS psychological attribution scale higher for patients ($M = 18.12$, $SD = 4.95$) than did behavioral medicine trainees ($M = 16.22$, $SD = 4.51$), $t(154) = 2.51$, $p < 0.05$, with the opposite being true for the IPQR-CS other attribution scale (behavioral medicine $M = 30.96$, $SD = 5.82$; medical residents $M = 26.45$, $SD = 7.00$) $t(154) = -4.39$, $p < 0.0001$.

Hypothesis 4

This hypothesis examined whether discrepancies between patients and their providers predict clinical indicators of care. Logistic regression models were estimated to predict, based on pain assessment discrepancies, whether a patient was referred for behavioral medicine services and whether patients were being prescribed low or high levels of opiates. Exact logistic regression, described above, was used when predicting whether patients who were referred for behavioral medicine services attended a visit. Separate models were estimated for each outcome. Additionally, independent models

were tested for two groups of discrepancy scores: 1. Medical Resident vs. Patient and 2. Behavioral Medicine Trainee vs. Patient. Discrepancies between patients and their providers were calculated by subtracting the patient's score from the provider's score. Thus, positive discrepancies were reflective of the provider having a higher rating and negative discrepancies indicated the patient's score was higher. Each of these models included discrepancy scores on NRS, PHQ, ORT, and psychological causal attributions. These discrepancy values were all included as independent predictors in each model. Taken together, these models aimed to estimate the overall level of pain-related discrepancy in the dyad.

To allow for comparison across opioid medications being used, all doses were converted into daily morphine equivalent doses (MEDs). The daily MED was calculated for a single prescription by multiplying the strength of dose by the quantity (i.e., recommended number of pills per day). In the case of PRN dosing the largest possible value was calculated, reflecting the highest recommended amount. Once a total daily opiate dose was obtained for individual prescriptions this was multiplied by the morphine equivalents factors recommended by Von Korff et al., (2008). Last, if patients were being prescribed more than one opioid, MEDS were summed across prescriptions to obtain a total daily MED value. For inclusion in the logistic models overall MED values were dichotomized into high and low risk MED groups. Low risk included MEDs of 5mg to 49mg and high risk included MEDs over 50mg per day. This cutoff was based on prior research indicating that patients receiving 50mg or greater MED per day were at 3-9 times greater risk of opioid-related mortality (Gomes, Mandani, Dhalla, Paterson, &

Juurlink, 2011), with other evidence suggesting a 4-7 fold increased risk of opioid overdose-related deaths (Bohnert et al., 2011).

Prior to model estimation assumptions of logistic regression were examined. All continuous IV's were found to be normally distributed, no outliers were present, and independence of observations was corrected for by grouping analyses at the medical resident level (discussed above). Examination of Pearson correlations, model coefficients, and standard errors revealed no concerns for multicollinearity. Additionally, model specification was examined to determine the appropriateness of the variables included in analysis. Covariates were either added or dropped based on model misspecification errors and efforts were made to minimize the overall number of variables included in the model. Due to the exact logistic models' inability to converge when estimating all discrepancy variables of interest, separate univariate models were run for each IV.

Referrals to Behavioral Medicine. Different results were obtained for the models estimating medical resident discrepancy vs. behavioral medicine trainee discrepancies. None of the models estimating discrepancies between behavioral medicine and patients was predictive of referral to behavioral medicine services. The overall model of discrepancies between medical residents and patients, with the number of years a medical resident had been training as a covariate, led to an appropriately fitting model, Hosmer-Lemeshow chi-square (8) = 11.93, $p = 0.15$. Significant predictors were the medical resident's training year as well as discrepancies on ORT score and psychological causal attributions of pain. Specifically, holding constant the other variables in the model, the odds of a patient being referred for a behavioral medicine visit increased .18 for each year increase in a medical resident's year in training. Additionally, patients were at 1.81

increased odds of being referred for a behavioral health visit for every one-unit discrepancy of the providers' ORT overestimation. Similarly, patients were found to have 1.15 increased odds of being referred for a behavioral medicine visit for every one-unit discrepancy in psychological causal attributions of chronic pain by providers. Full results of logistic analyses examining discrepancies between patients and their providers are presented in Table 3.

Patient Attendance at Behavioral Medicine Visits. Univariate exact logistic regressions revealed largely non-significant results across predictors for discrepancies between patients and both provider groups as predictors of behavioral medicine visits. The exception was models using NRS discrepancies between patients and behavioral medicine trainees and PHQ discrepancies for both providers. Specifically, for every unit that behavioral medicine trainees overestimated a patient's NRS score patients displayed half the odds of attending a visit with behavioral medicine, $OR = 0.53$, $p < 0.05$, 95% CI [0.23, 0.99]. Additionally, for both medical resident and behavioral medicine trainee discrepancy models, patients were at roughly a fourth the odds of attending a behavioral medicine appointment with every one-unit of provider overestimation of a patient's PHQ score, $OR = 0.26$, $p < 0.05$, 95% CI [0.04, 0.86]; $OR = 0.21$, $p < 0.05$, 95% CI [0.05, 0.88], respectively.

Table 3.
Logistic regression models testing patient and provider discrepancies ability to predict referrals for behavioral health services and MEDs.

	Referral for Behavioral Health			Daily MED's Load baseline			Daily MED's Load Follow-up		
				Discrepancy – medical resident & patient					
	OR	SE	CI	OR	SE	CI	OR	SE	CI
Patient Age				0.88**	0.04	0.80, 0.96	0.92	0.05	0.84, 1.02
Patient Gender				0.00	0.01	-0.00, 2.31	0.09	0.13	0.01, 1.46
Resident Year of Training	0.18**	0.11	0.06, 0.58						
NRS Discrepancy	1.07	0.09	0.91, 1.27	2.89	1.64	0.95, 8.80	1.87*	0.48	1.13, 3.08
ORT Discrepancy	1.81*	0.53	1.02, 3.20	0.54	0.42	0.12, 2.50	0.85	0.32	0.41, 1.76
PHQ Discrepancy	1.04	0.31	0.58, 1.87	2.32*	0.93	1.06, 5.07	0.74	0.29	0.34, 1.60
MPI-I Discrepancy	1.01	0.27	0.59, 1.70	0.98	0.60	0.30, 3.24	1.54	0.63	0.69, 3.41
Psych Attribution Discrepancy	1.15*	0.07	1.03, 1.29	1.21	0.20	0.88, 1.67	1.10	0.12	0.88, 1.37
				Discrepancy – behavioral medicine trainee & patient					
	OR	SE	CI	OR	SE	CI	OR	SE	CI
Patient Age				0.94	0.06	0.83, 1.05	0.94	0.05	0.84, 1.05
Patient Gender				0.08*	0.09	0.01, 0.64	0.31	0.23	0.07, 1.34
Resident Year of Training	0.24	0.18	0.06, 1.01						
NRS Discrepancy	1.02	0.13	0.80, 1.32	1.11	0.19	0.79, 1.55	1.19	0.22	0.83, 1.72
ORT Discrepancy	1.34	0.36	0.79, 2.28	0.49	0.28	0.16, 1.52	0.64	0.27	0.28, 1.45
PHQ Discrepancy	1.07	0.33	0.59, 1.96	1.26	0.61	0.48, 3.27	1.00	0.37	0.48, 2.07
MPI-I Discrepancy	0.75	0.26	0.38, 1.50	4.84*	3.51	1.17, 20.01	4.16**	2.28	1.42, 12.15
Psych Attribution Discrepancy	1.02	0.04	0.94, 1.11	1.15*	0.08	1.00, 1.31	1.11*	0.06	1.00, 1.24

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Exact logistic regressions predicting attendance at behavioral health visits is not presented in the above table. See results section for results of exact logistic models.

Daily MEDs. Results revealed the overall models were adequately specified and fit the data. Specifically, both baseline and follow-up daily MED models with medical resident discrepancies were a strong fit, Hosmer-Lemeshow chi-square (8) = 5.95, p = 0.65; Hosmer-Lemeshow chi-square (8) = 6.17, p = 0.63, respectively. The data using behavioral medicine trainee discrepancies were an adequate fit for the baseline and follow-up daily MED models, Hosmer-Lemeshow chi-square (8) = 13.82, p = 0.09; Hosmer-Lemeshow chi-square (8) = 14.47, p = 0.07, respectively. The full results of patient-provider discrepancies and their influence on MEDs can also be found in Table 3.

At baseline, discrepancy variables were found to predict the MEDs differently in the medical resident vs. the behavioral medicine trainee models. The medical resident discrepancy model revealed that age was significant, such that patients had 0.88 the odds of having risky MEDs with every year increase in their age. Additionally, the baseline model with medical resident discrepancies found that patients were twice as likely to be on high doses of opiates with every one-unit increase in PHQ discrepancy. On the other hand the behavioral medicine discrepancy model found no relationship with age, but found that male patients had nearly twice the odds of being prescribed high MEDs. Also, the behavioral medicine discrepancy model revealed that for every one-unit increase in discordance on interference ratings patients had 4.84 increased odds of having high MEDs. Similarly, patients displayed 1.15 increased odds of being prescribed risky MEDs with every one-unit increase in discrepant rating of psychological causal attributions of their chronic pain.

The three-month follow-up models of MEDs displayed similar results as the baseline models, with some unique differences. For the medical resident discrepancy

model only NRS discrepancies were significantly related to MED. Specifically, for every unit increase in NRS discrepancy between patients and their providers patients displayed 1.87 increased odds of being on high MEDs. The behavioral medicine discrepancy models were largely consistent with the baseline models. Patients displayed 4.16 increased odds of high MEDs for every unit increase in interference rating discrepancy and had 1.11 increased odds of being prescribed high MEDs for every unit increase in discrepant rating of psychological causal attributions of their chronic pain.

Hypothesis 5

This hypothesis sought to evaluate whether incongruent pain ratings between a patient's providers influenced clinical indicators of care. The analyses were nearly identical to those used to test hypothesis 4, however rather than testing discrepancies between patients and their providers these models examined the influence of discrepancies between provider groups. Calculating the discrepancies was similar to the other discrepancies, such that behavioral medicine trainees' scores were subtracted from medical residents' scores. Thus, positive discrepancies indicated that residents had a higher score and negative discrepancies were indicative of behavioral medicine trainees having the higher rating.

Again, prior to model estimation assumptions of logistic regression were examined. All continuous IV's were found to be normally distributed, no outliers were present, and independence of observations was corrected for by grouping analyses at the medical resident level (discussed above). Examination of Pearson correlations, model coefficients, and standard errors revealed no concerns for multicollinearity. Additionally, model specification was examined to determine the appropriateness of the variables

included in analysis. Due to the exact logistic models' inability to converge when estimating all discrepancy variables of interest, separate univariate models were run for each IV. Table 4 presents the full results of discrepancy models predicting referrals to behavioral medicine services, baseline MEDs, and 3-month follow-up MEDs.

Referrals to Behavioral Medicine. Results revealed that the overall model of provider discrepancies, with the number of years a medical resident had been in training as a covariate, led to an appropriately fitting model, Hosmer-Lemeshow chi-square (8) = 5.51, $p = 0.70$. Similar to the previous model estimating referrals from the discrepancy between medical resident and patient, the odds of a patient being referred for a behavioral medicine visit increased .18 as medical resident's year in training increased. Regarding the main predictors of interest, patients had 0.68 the probability of being referred for behavioral medicine services with every unit increase in ORT discrepancy between providers. Additionally, with every unit increase in psychological causal attribution discrepancy patients had 1.20 increased odds of being referred for a behavioral medicine visit. Together, these results suggest that discordant ratings by providers regarding opioid risk and psychological causal attributions of chronic pain are important factors when considering referral rates for behavioral medicine services.

Table 4.

Logistic regression models testing medical resident and behavioral medicine trainee discrepancies ability to predict referrals for behavioral health services and MEDs.

	Referral for Behavioral Health			Daily MED's Load baseline			Daily MED's Load Follow-up		
	OR	SE	CI	OR	SE	CI	OR	SE	CI
Patient Age				0.86*	0.06	0.76, 0.98	0.91	0.05	0.82, 1.01
Patient Gender				0.02**	0.02	0.00, 0.21	0.13*	0.13	0.02, 0.94
Resident Year of Training	0.18*	0.13	0.05, 0.75						
NRS Discrepancy	1.01	0.11	0.82, 1.24	2.78**	0.97	1.40, 5.49	1.97*	0.56	1.12, 3.44
ORT Discrepancy	0.68*	0.13	0.46, 0.99	0.94	0.49	0.33, 2.62	0.92	0.46	0.35, 2.45
PHQ Discrepancy	1.09	0.39	0.53, 2.21	3.68	3.40	0.60, 22.44	1.24	0.97	0.26, 5.73
MPI-I Discrepancy	2.61	1.35	0.95, 7.20	0.44	0.29	0.12, 1.63	0.62	0.30	0.24, 1.61
Psych Attribution Discrepancy	1.20**	0.08	1.06, 1.36	0.93	0.12	0.73, 1.19	0.89	0.09	0.73, 1.09

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Exact logistic regressions predicting attendance at behavioral health visits is not presented in the above table. See results section for results of exact logistic model.

66

Patient Attendance at Behavioral Medicine Visits. The univariate exact logistic regressions of discrepancies between providers predicting whether referred patients attended behavioral medicine visits were non-significant. Results revealed provider discrepancies on NRS, ORT, PHQ, interference, and psychological causal attributions of their chronic pain were all non-significant, $OR = 1.19$, $p = 0.53$, 95% CI [0.76, 2.08]; $OR = 1.21$, $p = 0.63$, 95% CI [0.66, 2.39]; $OR = 0.68$, $p = 0.69$, 95% CI [0.17, 2.46]; $OR = 1.99$, $p = 0.41$, 95% CI [0.50, 9.05]; $OR = 1.01$, $p = 0.91$, 95% CI [0.87, 1.19], respectively. These results are inconsistent with the proposed hypothesis that provider discrepancies would predict whether patients attended behavioral medicine visits.

Daily MEDs. Results revealed the overall models were adequately specified and fit the data. Specifically, both baseline and follow-up daily MED models with provider discrepancies and covariates of age and gender were a strong fit, Hosmer-Lemeshow chi-square (8) = 6.50, $p = 0.59$; Hosmer-Lemeshow chi-square (8) = 7.37, $p = 0.50$, respectively. Both the baseline and three-month follow-up models showed similar results when considering individual variables that were found to significantly predict normal or high MEDs. The only difference between the models was in the baseline model. Patients had 0.86 the odds of having risky MEDs with every year increase in age. Similar between the baseline and three-month follow-up models was that male patients had nearly twice the odds of being prescribed high MEDs. The only independent variable of interest found to be significantly predictive of normal or high MEDs was the discrepant provider scores on the NRS. Specifically, at baseline patients were found to have 2.78 increased odds of being on risky MEDs with every unit increase in provider NRS discrepancy, with the

odds decreasing to 1.97 at follow-up. These results suggest the importance of provider

discrepancies on rating patients' pain intensity and its potential impact on opioid dosing.

Discussion

The purpose of the present study was to investigate the influence of pain causal attributions on patient pain-related functioning, treatment engagement, and clinical outcomes. Additionally, the impact of discordance in chronic pain assessment domains between patients and their primary care providers was examined. Given that chronic pain treatment is ideally provided in a multidisciplinary manner, potential discrepancies in chronic pain causal attributions between providers were also examined. Overall, results revealed that patients' chronic pain attributions do influence pain-related functioning, however the impact is relatively small. There was also insufficient evidence to suggest that chronic pain attributions influence a patient's readiness to adopt self-management coping strategies and subsequent willingness to engage in treatment. Results did confirm that different medical care disciplines attribute the cause of patients' chronic pain in distinct ways. Importantly, discrepant views between providers negatively impact referrals for interdisciplinary services and were found to increase the risk of patients being prescribed high MEDs. Similarly, discrepancies between patients and their providers influence subsequent referral for behavioral medicine services, the patient's attendance at those visits, and their overall MED. Together these results suggest the important role chronic pain attributions can play in chronic pain assessment and treatment and bring to light the central role of the patient-provider and provider-provider relationship.

Causal Attributions and Pain-Related Functioning

The current study found mixed results for the impact of patients' chronic pain causal attributions and their influence across a range of pain-related functioning domains. Specifically, psychologically based attributions predicted greater symptoms of depression, as measured by the PHQ-9, however were not predictive of other pain domains. This finding is consistent with previous work demonstrating that individuals with co-morbid chronic pain and depression are more likely to attribute the cause of their pain symptoms to psychological and stress related factors (Hiller et al., 2010). This suggests that individuals might use similar information in determining the basis of depression symptoms as well as causal influences on pain. The literature suggests that a negative information bias is found in both individuals with depression (Katon, 2011) and chronic pain (Van Damme, Crombez, & Eccleston, 2004), supporting a causal and bidirectional relationship between depression and pain (Kroenke et al., 2012). Together, these findings confirm the important role psychologically based symptoms (e.g., stress, worry, emotional labiality) play in influencing the attention and attributions made by individuals with chronic pain and depression.

Psychologically based attributions were associated only with depressive symptoms, whereas having higher risk- related attributions and accident/chance attributions were predictive of greater risk of opioid misuse. Patients who scored high on the risk subscale of the IPQ-R causal scale endorsed causes related not only to their overall behavior, genetics, and aging, but also to diet, smoking, alcohol use, and having received poor medical care in the past. These risk factors of age, tobacco use, and alcohol

use are consistent with what the literature supports as major risk factors for opioid misuse (Ives et al., 2006; Page, Saidi, Ware, & Choiniere, 2015; Reid et al., 2002). It should also be noted that some patients who attribute their chronic pain to poor medical care likely are those who perceive a need for opiate medications but who have not received them due to being classified as high risk. The finding that accident/chance attributions are related to higher risk of opioid abuse could be reflective of a belief that their symptoms and management are beyond their control. This is consistent with research suggesting the importance of a sense of self-efficacy in successfully managing chronic pain (Smith et al., 2015; Thompson, Broadbent, Bertino, & Staiger, 2015). Interestingly there is scant literature specifically relating patient perceptions of pain to opioid misuse risk.

The only other significant association found in the present study between patients' causal attributions and pain-related functioning was that the average of all non-psychological attributions predicted greater functional impairments. This result is consistent with the common-sense model (Leventhal et al., 1980) which posits that patients who perceive their illness as due to chance, premorbid risk factors, and biological immunity adopt more passive coping strategies and experience greater impairments. The literature also suggests that chronic pain patients use more avoidant coping strategies if they perceive having a low sense of personal and treatment control (Hagger & Orbell, 2003) and psychological causal attributions are related to higher levels of personal control (Moss-Morris et al., 2002). This also extends research supporting the connection between active coping and adaptive pain-related beliefs being predictive of lower functional pain-related impairments (Tan, Teo, Anderson, & Jensen, 2011; Turner, Jensen, & Romano, 2000).

71

It is worth noting that the overall influence of causal attributions on pain-related functioning appeared to be relatively small, at most accounting for less than three percent of the variance in the outcomes. It is also interesting that psychological and other attributions were not inversely related. Just because a patient rated high levels of psychological attributions did not mean they did not also report high levels of other attributions. Rather than causal attributions being a single unidimensional construct patients appear to adhere to multidimensional ideas about their pain and its origins, consistent with a biopsychosocial conceptualization of chronic pain (Gatchel et al., 2007).

Causal Attributions, Readiness to Change, and Treatment Engagement

Although the common-sense model and the motivational model of pain self-management suggest relational connections among a patient's illness attributions, readiness to change, and treatment engagement the current study failed to find such associations. This could be reflective of patients with chronic pain anticipating roughly 25% symptom relief in treatment; however, reporting wanting upwards of 50% relief before they would move forward in treatment (Anderson, Hurley, Staud, & Robinson, 2015). Despite this, given robust evidence suggesting a relationship between pain-related beliefs and coping (see Tan et al., 2011; Turner et al., 2000) it is surprising that the present data did not find this association. This lack of relationship could be explained by a variety of factors.

First, the null relation between a patient's illness attributions, readiness to change, and treatment engagement was likely due in part to how these variables were operationalized in the current study. The most widely used measures of pain-related beliefs have been the Survey of Pain Attitudes (Jensen, Turner, Romano, & Lawler,

1994) and the Pain Beliefs and Perceptions Inventory (Williams & Thorn, 1989). These tools measure patients' thoughts regarding pain controllability, disability, medication, and treatment efficacy. They have been helpful in establishing the cognitive-behavioral approach to the management of pain and are widely supported in the literature. However, measures of causal attributions of chronic pain ask patients to attribute the causality of a variety of possible factors in relation to their chronic pain. Thus, it could be the null findings are suggestive of the discriminate value between pain-related beliefs and pain-related causal attributions. To date, aside from theoretical associations, there appears to be no published evidence linking chronic pain causal attributions and a patient's readiness to change.

While pain-related beliefs and causal attributions were important the manner in which treatment engagement was operationalized (attendance at behavioral medicine visits within three months from a referral being given) could have also influenced the null results. Although attending medical appointments is an important outcome to facilitate effective medical care, due to time constraints in recruitment the current study could only examine referral patterns and attendance within a three-month window over the course of a 12-month study period. Given only 30% of patients were referred (n = 24), with only six patients actually attending a behavioral medicine appointment, having a longer window of recruitment would have increased statistical power to detect possible relationships. In the process of collecting EMR data it was observed that only a small number of patients at the VCUHS primary care clinic who were referred for behavioral medicine services attended those appointments outside the three-month window. While the effects of having such a small sample were statistically controlled for it is likely that a

larger sample would have revealed a more nuanced relationship between causal attribution, readiness to change, and treatment engagement.

Additionally, measurement error could be a significant influence on these results. Although the MPRCQ2 has displayed adequate psychometric properties (Nielson et al., 2008; Nielson et al., 2009), qualitatively the author noticed a number of patients struggling to understand the prompts and how to respond to the MPRCQ2 items. Whereas the MPRCQ2 is written at a third grade reading level this cutoff might underestimate the difficulty some patients could have experienced responding accurately to the measure. This could have been exacerbated in the present study sample given the relatively indigent population the clinic served.

Patient and Provider Discrepancies

The current study expected to find a predictive relationship between patient-provider discrepancies and three-month outcome data. Specifically, larger discrepancies on ratings of causal attributions, intensity, interference, opioid risk, and depression were expected to predict lower referral rates, less attendance at behavioral health sessions, and being prescribed higher MEDs. Results confirmed that some, but not all, patient-provider discrepancies predicted three-month follow-up clinical outcomes.

Behavioral Medicine Referrals. The current findings revealed interesting non-discrepancy provider level factors that influenced referral to interdisciplinary services. It was found that when a patient was referred for behavioral medicine services it was more likely to come from a pgy2 resident than a pgy3. One would expect this relationship to be influenced by providers' attitudes toward treating patients with chronic pain. However, the difference between second and third year residents' attitudes towards treating patients

with chronic pain was minimal. It is possible then that providers with less training were more likely to refer because of their relative lack of experience. This is consistent with evidence that as providers gain more experience with treating patients with chronic pain they gain more confidence (Jamison, Sheehan, Scanlan, Matthews, & Ross, 2014) and could see less utility in seeking interdisciplinary help. Additionally, these results could alternatively reflect residents with less training receiving more specialized training in effective chronic pain management. Systemic efforts in recent years have sought to increase medical students' training in chronic pain management (IMO, 2011), such that younger residents might have a broader perspective on how to effectively treat chronic pain and thus be more likely to refer for behavioral medicine services.

Aside from provider factors there were interesting discrepancy factor relationships with referral patterns. First, discrepancy scores between behavioral medicine trainees and patients did not predict whether the patients were referred for behavioral medicine services. This finding was not surprising since behavioral medicine providers did not actively attempt to influence whether the medical residents would submit referrals, unless the patient requested the behavioral medicine provider to communicate their interest in a referral. While clinical services in interdisciplinary primary care clinics involve frequent communication between providers to facilitate effective referring, that dynamic was not present in the setting of the current study. A number of discrepancies between patients and their internal medicine provider were noted to predict referral patterns. The most prominent of these was patient-provider discordance on the patient's risk for opioid misuse. Specifically, residents were almost two times more likely to refer a patient to behavioral medicine when the provider

estimated a higher risk of misuse than the patient. This finding suggests that referral to interdisciplinary services is not solely dependent on a patient's overall risk. It is possible that clinic encounters that are strained around the issue of opioid prescribing where patients disagree with the providers overall assessment of risk can be viewed by the provider as "drug-seeking" or an effort to minimize risky behaviors. Alternatively, providers who overestimate risk might be biased toward referring patients for behavioral medicine services to help manage substance abuse concerns. This discrepancy could be part of what fuels the tensions providers experience in prescribing opioids and patients' feelings of being misunderstood (Bergman, Matthias, Coffing, & Krebs, 2013).

The other factor that was predictive of referrals to behavioral medicine services was patients and providers having discrepant views regarding psychological causal attributions. This result points to the likelihood that medical residents were more likely to refer a patient for services, especially when they felt the patient's pain was being caused by psychological factors. It is important to note that while this effect was statistically significant, from a clinical standpoint the increased odds of referring were relatively small (OR = 1.15). However, again it is interesting that it was the discrepancy that was predictive of referrals rather than the overall level of psychological factors that were considered causal. This could reflect providers identifying the patients who have the greatest need for services. The literature suggests that high levels of psychological attributions will promote more adaptive coping (Hagger & Orbell, 2003; Moss-Morris et al., 2002). Thus if patients see themselves as low on psychological attributions they could be engaging in less adaptive methods of coping. Providers assessing higher levels of

76

psychological attributions for these patients would then appropriately feel they could benefit from behavioral medicine services.

Thus, when considering the interpersonal dynamics between patients and their providers, disagreement in risk for opioid use and the psychological nature of their symptoms were associated with providers referring for behavioral medicine services. This is contrary to Panda and colleagues' (2006) conclusion that discordant patient-physician pain assessment could lead to decreased access to supportive services. On the contrary, these results suggest they could lead to increased referrals. It might be that providers reserve referrals for interdisciplinary services for the "difficult" patients who present inconsistently, overtly disagree with the physician's treatment plan, or who appear to underreport their symptoms. Alternatively, this could reflect the physician's appropriate use of interdisciplinary services within the clinic when they have been unable to successfully engage a patient. Either way, referring patients for appropriate interdisciplinary services is important in effective pain management. And while previous literature has generally examined patient-provider discrepancies regarding pain intensity, these findings add uniquely to the body of evidence suggesting the importance of discrepant pain assessment between patients and their medical providers. Specifically, this points to the important role causal attributions might play in the social cognitive glue of the pain assessment and treatment process.

Behavioral Medicine Attendance. Depression rating discrepancies as well as pain intensity discrepancies were predictive of patient attendance at behavioral medicine visits. Regardless of which provider was evaluating the patient, there was roughly one-fourth the likelihood of attending if either the behavioral medicine provider or medical

resident rated depression higher than the patient. This is intuitive in the sense that if the patient didn't rate their own depressive symptoms highly they would likely see less of a need to attend. It is also consistent with evidence that Latino patients being referred by primary care providers for integrated services were more likely to attend if they perceived the referral as consistent with their believed cause of symptoms (Horevitz, Organista, & Arean, 2015). It is also possible that some patients attempt to underreport psychological symptoms in order to receive desired medical treatments for their pain (Davis, Kyle, Thorp, Wu, & Firnhaber, 2015). Other evidence points to the fact that when patients assess and describe their pain they are more likely to use affective and broader quality of life domains as indicators of pain severity and impairment (Brown, 2004; Brown, 2005). Thus patients might not view themselves as experiencing depressive symptoms because they are reporting their pain symptoms. Additionally, chronic pain and depression have deleterious effects on executive functioning (Baker, Gibson, Georgiou-Karistianis, Roth, & Giummarra, 2015). Thus, it could be that part of the disconnect between patients and providers in rating depressive symptoms is related to cognitive deficits. These cognitive impairments would also impact patients' ability to accurately navigate the medical system and attend scheduled medical appointments.

In addition to depressive symptom discrepancies, pain intensity discrepancies predicted attendance. Interestingly, the association between pain intensity discrepancy and attendance was seen for patient-behavioral medicine discrepancies but not with medical residents. Specifically, patients were half as likely to attend if behavioral medicine providers rated their pain intensity higher than they did. It is curious that patients were less likely to attend if a provider overestimated their pain. It seems

78

reasonable that patients would feel more understood and appreciate a provider who took their reports of pain seriously and would be more inclined to attend these visits. Evidence points to often competing values between patient and provider which can leave patients feeling misunderstood (Frantsve & Kerns, 2007; Upshur, Baciqalupe, & Luckmann, 2010) with providers often underreporting the patient's pain (Panda et al., 2006). Thus, one would think patients would be more likely to attend if they felt the intensity of their pain experience was being understood. However, again consistent with the above findings for depressive symptoms, if the patient doesn't perceive a need then they would be less likely to attend, even if they appreciated the providers validating stance regarding the intensity of their pain.

MEDs. The present study ran separate models for discrepancies between provider type as well as for baseline opioid dose and opioid doses at three-month follow-up. The results confirmed that some patient-provider discrepancies were predictive of patients being on higher MEDs, however these results varied depending on the model under consideration. The author is currently unaware of no other published work to date examining such relationships.

Considering medical residents' discrepancies with patients, at baseline larger discrepancies on the patient's overall rating of depression were predictive of more than twice the likelihood of patients being prescribed a risky amount of opioids. This builds off evidence suggesting a relationship between depressive symptoms and opioid use beyond the impact of pain severity and physical function limitations (Goesling et al., 2015). Additionally, this is concerning given that depression has been associated with greater risk of prolonged opioid use and increased rates of overdose (Kuo, Raji, Chen,

Hasan, & Goodwin, 2015). However, the current findings also suggest the need to consider factors beyond the patient's reported level of depression and include provider impressions of the patients' symptoms. This baseline model also showed that patients who were younger on average were also at higher risk. This finding is consistent with large epidemiological trends showing higher average opioid dosing at younger ages (Campbell et al., 2010). Follow-up results revealed that only pain intensity discrepancies were associated, such that discordance was associated with nearly a two-fold increased odds of being on high dose opioids. This is consistent with previous work connecting NRS discrepancies with clinical outcomes (Panda et al., 2006; Mantyselka et al., 2001). One would assume though that if a patient and provider disagreed on their intensity of their pain the provider might be less inclined to prescribe opiates. However, these results reflect the unique situation where a provider overestimates pain intensity compared to the patient. It could be that these patients are seen as the lowest risk for abuse and thus the providers feel more comfortable prescribing higher MEDs. The present study is the first to show a relationship between pain intensity discrepancies and opioid prescribing patterns.

Discrepancies between behavioral medicine providers and patients were found to have a very different impact on MEDs. First, findings from the baseline model found that males were twice as likely to be on high MEDs. While there is mixed evidence in the literature regarding gender associations with high dose opioid prescribing (Back et a., 2009; Campbell et al., 2010), the current study provides additional evidence that men are more likely than women to be prescribed opioids, particularly at high doses. Additionally, the baseline model in the current study found that discrepancies on psychological causal

attributions and pain-related interference were associated with increased risk of being on high dose MEDs. The interference discrepancy should, however, be considered with caution given the relatively large standard error and confidence interval. Also, it should be recognized that the impact of discrepant psychological causal attributions was minimal, with only 1.15 increased odds. Even with the small effect, the results suggest that residents prescribe high levels of opioid medication even when other providers perceive higher psychological influences than the patient themselves. This would be consistent with patients seeking medication for treatment when they perceive low treatment control, via low psychological causal attributions (Hagger & Orbell, 2003; Moss-Morris et al., 2002). Thus, it could be that patients who perceive the necessity of opiate medications might be perceived by providers as having more emotional lability contributing to their pain presentation. At three-month follow-up the results for the behavioral medicine-patient discrepancy models were largely consistent. The only difference was that the effect of gender was lost.

Differences Between Disciplines

Given that different disciplines approach chronic pain from unique points of view the current study hypothesized that providers would have discrepant ratings of patients' pain functioning. Results confirmed this association, such that behavioral medicine providers rated pain intensity and depression higher than internal medicine providers, whereas internal medicine providers rated psychological attributions higher than behavioral medicine. It makes sense to find that providers use different information to assess a patients' chronic pain. Internal medicine residents are medical doctors trained to evaluate the physical functioning of the patient and behavioral medicine trainees focus on

evaluating the broad psychosocial functioning of patients. Thus, these different lenses are both distinct and complementary in the context of assessing and treating chronic pain. However, it is good to recognize that both provider groups were on average in agreement on patients' overall risk for opioid abuse. This is significant given the level of concern providers have over the use of opioids (Upshur et al., 2006), and the likelihood for discrepancies in this area to cause rifts in interdisciplinary team functioning.

Specific discrepancies indicated that behavioral medicine trainees overall rated levels of depression higher than internal medicine residents. One explanation could be that the medical residents were relying too heavily on screening tools to assess the presence of depressive symptoms (Moore et al., 2012). This is consistent with evidence suggesting elevated false-negative diagnostic rates of depression among primary care providers (Tiemens, Von Korff, & Lin, 1999), especially outside the setting of integrated care (U.S. Preventive Services Task Force, 2002). Although using screening tools to assess the full range of chronic pain functioning is consistent with professional guidelines (ICSI, 2011; Sanders, Harden, & Vincente, 2005) there are often nuances to accurately assessing depression that go beyond screening tools. Alternatively, it could be that behavioral medicine providers are more likely to attribute emotional distress to underlying depressive symptoms; however, this would be considered less likely given these providers' clinical experience in diagnosing mood disorders. Overall, it is necessary to highlight that while the difference between these groups was statistically significant, the overall difference was of questionable clinical significance and should be considered in that light.

Behavioral medicine providers also rated pain intensity higher on average than medical residents. This builds off evidence suggesting that medical providers tend to underreport patients' pain intensity ratings compared to patients (Panda et al., 2006; Mantyselka et al., 2001). The current data intimate the possibility that behavioral medicine providers are less inclined to underestimation. However, it is important to keep in mind that these were average differences and there is variability within groups. Interestingly there was a wider spread of ratings within medical residents than behavioral medicine trainees, however it was not statistically significant, $F(74, 78) = 1.45, p = 0.11$. This could be reflective of a variety of patient, provider, and environmental factors or the fact that there were twice as many internal medicine residents in the study than behavioral medicine trainees.

The final mean difference between internal medicine and behavioral medicine providers was on the psychological causal attributions of chronic pain, such that internal medicine residents rated patients higher. While broad evidence highlights primary care providers' general uneasiness treating chronic pain (Green et al., 2001; Jamison et al., 2014; Upshur et al., 2006), the current findings also suggest this uneasiness could be related to the providers' own causal attributions. Given that reports estimate that a majority of medical residents lack significant training in chronic pain management (Green et al., 2001; Institute of Medicine, 2011) it seems reasonable that medical providers would attribute more of chronic pain patients' symptoms to psychologically based factors. Additionally, the data indicated that behavioral medicine providers rated patients lower on psychological causal attributions. This seems to appropriately reflect

psychology's focus on the multifactorial etiology and treatment of chronic pain (Gatchel et al., 2007).

Provider Discrepancies

Aside from the average trends of these provider groups to rate pain-related functioning differently, these discrepancies were predicted to impact clinical outcomes. The chronic pain literature has yet to produce evidence speaking to the influence of discrepancies between providers in interdisciplinary settings and their impact on clinical outcomes. However, if patients with chronic pain are being treated by interdisciplinary team members it stands to reason that potential discrepancies within the team could influence treatment. As discussed above, Panda and colleagues' (2006) work has demonstrated the impact of patient-provider discrepancies on patient outcomes and as healthcare delivery models continue to shift towards integrated care and accountable care (Davis et al., 2011; Jacobson & Jazowski, 2011) considering the impact of discrepant views between providers on a team is warranted.

Behavioral Medicine Referrals. Results were mixed for provider-provider discordance being predictive of whether a patient is referred for behavioral medicine services; however, they were largely consistent with the above mentioned patient-provider discrepancy model. Again, younger residents were found to be more likely to refer and discordant provider ratings on psychological causal attributions were predictive of referrals, such that a higher medical resident compared to a lower behavioral medicine rating was predictive of higher rate of referral. This is consistent with the common trend in interdisciplinary teams for medical providers to serve as the "gatekeepers" for treatment coordination and planning (Gatchel et al., 2014). These data also suggest that

medical residents appropriately refer patients with chronic pain to multidisciplinary services when they perceive the patient's pain being influenced by psychological factors. However, since the result was only in the case of discrepancy ratings, it could also be reflective of teams that, despite holding discordant views on the cause of the patient's pain, agree that multimodal treatment can help optimize chronic pain outcomes.

Despite the consistency between patient-provider and provider-provider models, contrary to the proposed hypotheses, results revealed a surprising relationship between discrepant provider ratings of opioid abuse risk and referral for behavioral medicine services. Whereas large patient-provider discrepancies were predictive of higher odds of being referred, higher discordance between providers was associated with nearly half the odds of being referred. It was not expected that there would be opposite outcomes between patient-provider and provider-provider discrepancies, particularly when considering a patient's risk for opioid abuse. It suggests that disagreement between providers on a patient's level of opioid risk could lead to confusion within the team or the perception that interdisciplinary services are not warranted at the time. It is also plausible that if a medical resident perceived more risk than the behavioral medicine provider the patient could have been referred to other services, such as psychiatry, and the provider might see less need for a referral to behavioral medicine. It could also be that residents who perceive a high risk of opiate abuse are following the care of these patients more closely regardless of what other providers attribute their risk to be. If they perceive a high risk of opioid abuse they might choose to increase the frequency of follow-up visits and thus feel comfortable in the level of care the patient is receiving. These are possible explanations and warrant further investigation.

Behavioral Medicine Attendance. Although some pain assessment discrepancies between providers were predictive of referrals to behavioral medicine the same was not true for attendance at these visits. Contrary to our hypotheses, no provider-provider discrepancies were found to predict subsequent attendance within a three-month period. While it is still reasonable that patients might be less likely to attend should they perceive the discordant view of their providers, the current data suggest that patient-provider discrepancies are more useful to consider. This is consistent with the patient-provider relationship data suggesting increased engagement in interdisciplinary treatment when the dyad is able to communicate openly and share in treatment decision-making (Horevitz et al., 2015). There are even suggested neurobiological mechanisms that facilitate proactive engagement in a more caring patient-provider relationship (Zender & Olshansky, 2012). Thus, examining discrepancies between providers, while eliminating the patient, might be less useful given the patient is central to the process of adherence and attendance.

MEDs. The current investigation ran separate models for baseline opioid dose and opioid doses at three-month follow-up. Only one of the pain domain discrepancies between providers was predictive of MEDs. Importantly, there were substantial differences between the previously mentioned patient-provider results and the models estimating provider discordance. However, the baseline and follow-up models of provider discrepancies were largely consistent. These results add valuable insight into factors that could influence provider prescribing of opioids and that have yet to be examined in the literature.

The effect of gender on MEDs was more consistent in the provider-provider than the patient-provider discrepancy models, such that males had nearly twice the odds of being prescribed high MEDs. These findings are consistent with the baseline model for patient-behavioral medicine discrepancies and provide further evidence that males are more likely to be prescribed higher dose opiate medications. While demographic variables at both the patient and provider level are known to influence the rate of opiate prescribing (Tait & Chibnall, 2014) the largest effect in the current data set was for the influence of provider discrepancies in estimates of pain intensity on MEDs. Specifically, when internal medicine residents rated pain intensity higher than behavioral medicine providers patients were at 2-3 times the increased odds of being on high dose MEDs. These findings fit nicely with work, described above, which found that discordant patient-provider ratings of pain intensity were associated with both physical functioning and overall bodily pain (Panda et al., 2006). However, Panda and colleagues' work did not assess whether patient-provider discordance could influence prescribing patterns. The current results extend this previous work by showing that discrepant views between providers caring for the same patient can impact patient care to the point of influencing the amount of opiate medications that patients are being prescribed.

What could account for this unique association? One possible explanation relates to findings of the present study discussed previously that indicate on average medical providers tend to underestimate pain ratings compared to behavioral medicine providers. It could be concluded that there were relatively few instances in the current study where residents rated pain intensity higher than behavioral medicine trainees. This may be because the current sample of patients who were on high MEDs were seen frequently by

medical providers and may have been reporting low levels of pain to the residents. Thus, behavioral medicine providers might have been less attuned to the significant pain the patient experienced but that was well managed on medication. Conversely, the medical provider could have been more influenced by the patient's history of pain reporting and thus biased to estimate higher pain intensity and to prescribe higher dose pain medication. An additional explanation could be that medical providers were biased towards rating the patient's pain higher to justify their high dose prescribing. This interpretation would be consistent with literature showing providers base opioid prescribing on their clinical judgment in conjunction with objective data available about opioid misuse risk (Smith et al., 2015; Weiner et al., 2013). It could also be that the discordance between team providers was the result of accurate assessments on both parts, such that behavioral medicine providers observed less pain and possibly less need for other interdisciplinary intervention. Medical providers then were more likely to prescribe high dose MEDs in an effort to aid the patient. While it is currently unclear exactly why this relationship exists it warrants further consideration given the significant concerns regarding opioid prescribing.

Limitations and Future Directions

There are a number of limitations to consider when interpreting the present study's findings. First, it is important to consider the clinic environment these patients and providers were being sampled from—an academic training clinic that services an urban area of largely indigent patients. Generalizing findings to any interdisciplinary primary care clinic could be problematic.

Another limitation worth consideration is sample size. Due to practical constraints of time and available resources, recruitment was terminated prior to having the desired number of participating patients within each resident patient panel. Although 80 patients is an adequate size to answer a variety of important questions, the current study's data structure lacked the power to perform multilevel analyses or structural equation modeling. These types of analyses could yield additional information about within and between group differences and changes over time.

A further drawback to the current study is the brief follow-up period. This could have constrained both the quantity and quality of data obtained. The 12-week follow-up window was selected based on clinic policies of requiring visits every 90 days for patients who were being prescribed opiate medications. However, nearly half, n = 35, of the sample didn't see their clinic provider within the required 90-day window. Thus, 44% of the data that would have been used to determine if referrals, attendance, or meaningful changes had occurred in the patient's plan of care were not available. However, even for patients who did follow-up within the 12-week period it was less likely for changes in clinical care to be observed because most residents had little history with the patient. Of the patients who returned for follow-up, 60% had never seen the medical resident before, with an additional 10% having seen the resident once before. While residents do have access to the patient's EMR data, it seems unlikely for a provider to make significant changes in treatment plan after one or two visits. Follow-up data collection also relied only on EMR data for indicators of quality of care. While these were germane to the study's main hypotheses, having additional patient-reported data about pain-related functioning would have allowed for longitudinal analyses investigating causal links

between attributions and outcomes. Future research should capitalize on having multi-year time points for data collection.

Last, it is important to recognize the potential differences between the behavioral medicine trainees' and medical residents' ability to evaluate a patient's chronic pain. Although efforts were made to maximize comparability between the disciplines' ratings (e.g., limiting the sample to 2nd and 3rd year residents, statistically accounting for number of previous visits with patient, etc.) it is likely that differences in patient knowledge remained. Medical residents had access to the patient's chart prior to their visit and spent more time doing their evaluation. Behavioral medicine trainees often only had between five and ten minutes with a patient. These differences could have influenced the providers' ability to accurately rate the patient's pain-related functioning.

Despite these limitations, the current findings make important contributions to the literature. They show that different medical disciplines attribute causal influences to patients' chronic pain differently, that patients' own attributions about their pain are predictive of their pain-related functioning, and that discrepant views between patients and their medical providers, as well as between providers, do impact important clinical indicators of care. The findings highlight the importance of providing clear education to patients about the nature of chronic pain and its multifactoral origins and treatment. Clinically this could provide opportunities to discuss causal attributions in a patient-centered manner and could facilitate collaborative decision-making. Future research should investigate the impact educational interventions can have on shifting chronic pain causal attributions and its subsequent impact on pain-related functioning. There appears to be initial evidence that causal attributions can act as social cognitive glue within the

patient-provider and provider-provider dyad when assessing and treating chronic pain.

The findings point to the importance of discordant chronic pain attributions as key

implementation barriers for multidisciplinary chronic pain treatment. It will also be

important to further investigate what factors drive discrepant views within

interdisciplinary team functioning. If medical care is affected by team dynamics, this

could be a fruitful area of investigation. Additionally, future research will need to further

elucidate meditational and causal links between pain-related attributions, patient

engagement, and patient-provider communication and specific clinical outcomes. Being

able to further explore these issues should continue to improve patient education and the

medical fields' ability to provide effective multidisciplinary chronic pain assessment and

treatment.

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Appendix A

Patient Survey

Please indicate how much you agree or disagree with the following statements about your chronic pain.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There is a lot which I can do to control my chronic pain	1	2	3	4	5
What I do can determine whether my chronic pain gets worse or better	1	2	3	4	5
The course of my chronic pain depends on me	1	2	3	4	5
Nothing I do will affect my chronic pain	1	2	3	4	5
I have the power to influence my chronic pain	1	2	3	4	5
My actions will have no affect on the outcome of my chronic pain	1	2	3	4	5
There is very little that can be done to improve my chronic pain	1	2	3	4	5
My treatment will be effective in curing my chronic pain	1	2	3	4	5
The negative effects of my chronic pain can be prevented (avoided) by my treatment	1	2	3	4	5
My treatment can control my chronic pain	1	2	3	4	5
There is nothing which can help my condition	1	2	3	4	5

We are interested in what <u>you</u> consider may have been the cause of your chronic pain. As people are very different, there is no correct answer for this question. We are most interested in your own views about the factors that caused your chronic pain rather than what others including doctors or family may have suggested to you. Below is a list of possible causes for your chronic pain. Please indicate how much you agree or disagree that they were causes for you by marking the appropriate box.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Stress or worry	1	2	3	4	5
Hereditary–it runs in my family	1	2	3	4	5
A germ or virus	1	2	3	4	5
Diet or eating habits	1	2	3	4	5
Chance or bad luck	1	2	3	4	5
Poor medical care in my past	1	2	3	4	5
Pollution in the environment	1	2	3	4	5
My behavior	1	2	3	4	5
My mental attitude, e.g. thinking about life negatively	1	2	3	4	5
Family problems or worries caused my pain	1	2	3	4	5
Overwork	1	2	3	4	5
My emotional state, e.g. feeling down, lonely, anxious, empty	1	2	3	4	5
My personality	1	2	3	4	5
Ageing	1	2	3	4	5
Alcohol	1	2	3	4	5
Smoking	1	2	3	4	5
Accident or injury	1	2	3	4	5
Altered immunity	1	2	3	4	5

On a scale of 0 to 10, with 0 being no pain at all and 10 being the worst pain imaginable, how would you rate your pain RIGHT NOW?

0	1	2	3	4	5	6	7	8	9	10
No Pain										Worst Pain Possible

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3
Overall: What is your current level of depression?	0	1	2	3

Please mark each box that applies. Check boxes under the "Female" column if you are female and under the "Male" column if you are male.

	Female	Male
Family History of Substance Abuse		
Alcohol	[ ]	[ ]
Illegal drugs	[ ]	[ ]
Prescription drugs	[ ]	[ ]
Personal History of Substance Abuse		
Alcohol	[ ]	[ ]
Illegal drugs	[ ]	[ ]
Prescription drugs	[ ]	[ ]
Age (mark box if between 16 and 45)	[ ]	[ ]
History of Preadolescent Sexual Abuse	[ ]	[ ]
Psychological Disease		
Attention deficit disorder, obsessive compulsive disorder, bipolar, schizophrenia	[ ]	[ ]
Depression	[ ]	[ ]

Brief MPRCQ2

Please circle the number that best indicates your intention to use each of the following methods of coping with or managing your pain by using the 1 to 7 rating scale below:

1 = I am not doing this now, and am not interested in ever doing it.
2 = I might do this someday but I have made no plans to do it.
3 = I will probably start doing this sometime (in the next six months).
4 = I have made plans to start doing this soon (within the next month).
5 = I have recently started doing this (within the past month).
6 = I have been doing this for a while (more than a month but less than 6 months).
7 = I have been doing this for a long time (at least 6 months).

1. Break up tasks into small pieces to get more done.	1	2	3	4	5	6	7
2. Use correct body posture when sitting.	1	2	3	4	5	6	7
3. Exercise for at least 30 minutes three times a week or more.	1	2	3	4	5	6	7
4. Put the pain in the background.	1	2	3	4	5	6	7
5. Alter the pain with my mind so it is less intense.	1	2	3	4	5	6	7
6. Use slow, deep breathing to relax.	1	2	3	4	5	6	7
7. Keep on doing what I want to do despite pain.	1	2	3	4	5	6	7
8. Concentrate on a hobby or chore to distract myself from pain.	1	2	3	4	5	6	7
9. Think about the pain differently so that it hurts less.	1	2	3	4	5	6	7
10. Let others know what I want and need.	1	2	3	4	5	6	7
11. Use my mind to distract myself from the pain.	1	2	3	4	5	6	7
12. Lift heavy objects safely by keeping my back straight.	1	2	3	4	5	6	7
13. Remind myself often that I will feel better in the future.	1	2	3	4	5	6	7
14. Ignore the pain sensations.	1	2	3	4	5	6	7
15. Picture calming images to relax.	1	2	3	4	5	6	7
16. Pace myself so I can keep working slowly and steadily.	1	2	3	4	5	6	7
17. Tell myself often that I am doing well despite the pain.	1	2	3	4	5	6	7
18. Tell people I am close to how I feel.	1	2	3	4	5	6	7
19. Stretch the muscles where I hurt (for at least 5 minutes) three times a week or more.	1	2	3	4	5	6	7

The following questions are slightly different than those that you have already answered. For the remaining questions, please circle the number that best indicates your intention to stop using each of the methods of coping with or managing your pain by using the 1 to 7 rating scale below:

1 = I am doing this now and am not interested in ever stopping.
2 = I might stop this someday, but I have made no plans to stop doing it.
3 = I will probably stop doing this sometime (in the next six months).
4 = I have made plans to stop doing this soon (within the next month).
5 = I have recently stopped doing this (sometime in the past month).
6 = I have not done this for a while (more than a month but less than 6 months).
7 = I have not done this for a long time (at least 6 months).

20. Ask for help with chores when I hurt.	1	2	3	4	5	6	7
21. Sit down to rest when I hurt.	1	2	3	4	5	6	7
22. Allow pain to keep me from doing what I need to do.	1	2	3	4	5	6	7
23. Think about how overwhelming the pain feels.	1	2	3	4	5	6	7
24. Lie down to rest when I hurt	1	2	3	4	5	6	7
25. Ask others for help when I hurt.	1	2	3	4	5	6	7
26. Tell myself 'I can't stand this pain.	1	2	3	4	5	6	7

In the following questions, you will be asked to describe your pain and how it affects your life. Under each question is a scale to record your answer. Read each question carefully and then circle a number on the scale under that question to indicate how that specific question applies to you.

	No Interference						Extreme Interference
2. In general, how much does your pain problem interfere with your day-to-day activities?	0	1	2	3	4	5	6

	No Change						Extreme Change
3. Since the time you developed a pain problem, how much has your pain changed your ability to work? ___ Check here, if you have retired for reasons other than your pain problem	0	1	2	3	4	5	6
4. How much has your pain changed the amount of satisfaction or enjoyment you get from participating in social and recreational activities?	0	1	2	3	4	5	6
8. How much has your pain changed your ability to participate in recreational and other social activities?	0	1	2	3	4	5	6
9. How much has your pain changed the amount of satisfaction you get from family-related activities?	0	1	2	3	4	5	6
13. How much has your pain changed your marriage and other family relationships?	0	1	2	3	4	5	6
14. How much has your pain changed the amount of satisfaction or enjoyment you get from work? __ Check here, if you are not presently working.	0	1	2	3	4	5	6
17. How much has your pain changed your ability to do household chores?	0	1	2	3	4	5	6
19. How much has your pain changed your friendships with people other than your family?	0	1	2	3	4	5	6

	None	Low	Mod	High
Overall: What is your current level of pain-related interference?	0	1	2	3

Do you agree with your doctor's treatment plan for your pain?
YES / NO

If given a referral to see behavioral medicine as part of your pain management, would you attend?
YES / NO

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

Disagree Strongly	Disagree Moderately	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Moderately	Agree Strongly
1	2	3	4	5	6	7

I see myself as:
1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

Appendix B

Provider Survey

Your responses to these questions are to reflect YOUR CLINICAL OPIONION, not necessarily what your patient reported.

On a scale of 0 to 10, with 0 being no pain at all and 10 being the worst pain imaginable, how would you rate your patient's pain when you saw him or her for their medical visit.

0	1	2	3	4	5	6	7	8	9	10

No Pain

Worst Pain Possible

Below is a list of possible causes for your patient's chronic pain. Please indicate how much you agree or disagree that they were causes for your patient's pain by marking the appropriate box.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Stress or worry	1	2	3	4	5
Hereditary–it runs in your patient's family	1	2	3	4	5
A germ or virus	1	2	3	4	5
Diet or eating habits	1	2	3	4	5
Chance or bad luck	1	2	3	4	5
Poor medical care in your patient's past	1	2	3	4	5
Pollution in the environment	1	2	3	4	5
Your patient's behavior	1	2	3	4	5
Your patient's mental attitude, e.g. thinking about life negatively	1	2	3	4	5
Family problems or worries caused your patient's pain	1	2	3	4	5
Overwork	1	2	3	4	5
Your patient's emotional state, e.g. feeling down, lonely, anxious, empty	1	2	3	4	5
Your patient's personality	1	2	3	4	5
Ageing	1	2	3	4	5
Alcohol	1	2	3	4	5
Smoking	1	2	3	4	5
Accident or injury	1	2	3	4	5
Altered immunity	1	2	3	4	5

Is your patient's pain experience caused by the fact they are dependent/addicted to pain medications?   YES / NO

Would you recommend this patient seek behavioral medicine services?   YES / NO

What is your patient's current…	None	Low	Moderate	High
Level of pain-related interference?	0	1	2	3
Level of depression?	0	1	2	3
		Low	Moderate	High
Risk of opioid abuse?		1	2	3

Rate the following items from the perspective of treating patients with chronic pain.

	Strongly Disagree	Disagree	Not sure but probably disagree	Not sure but probably agree	Agree	Strongly Agree
I prefer not to work with patients like this	1	2	3	4	5	6
Working with patients like this is satisfying	1	2	3	4	5	6
I can usually find something that helps patients like this feel better	1	2	3	4	5	6
Treating patients like this is a waste of medical dollars	1	2	3	4	5	6

Appendix C

Means table for all patient and provider measures

Shared Measures	Patients		Internal Medicine		Behavioral Medicine	
	M	*SD*	*M*	*SD*	*M*	*SD*
IPQR-CS						
psych attrib.	15.26	4.95	18.11	4.98	16.16	4.52
chance attrib.	5.88	1.85	5.04	1.85	6.39	2.07
risk attrib.	18.11	4.97	16.39	4.77	19.35	3.78
immunity attrib.	7.05	2.60	5.00	1.84	5.18	2.41
NRS	6.30	2.31	4.16	2.33	5.08	1.93
Overall Depression	1.15	1.09	1.17	0.81	1.49	0.83
Overall Opioid Risk	1.73	0.80	1.51	0.64	1.56	0.67
Overall Interference	2.44	1.38	1.63	0.80	2.10	0.74
Patient Measures						
IPQR-personal control	15.39	3.85				
IPQR-treatment control	13.70	2.76				
PHQ9	11.22	6.81				
ORT	4.98	5.16				
MPRCQ2	37.80	9.28				
MPI-IS	4.30	1.38				
Conscientiousness	4.98	1.45				
Provider Measures						
4-item MCRS			17.28	3.18	20.19	2.77

Vita

Bryan James Jensen was born in Murray, Utah on June 18th, 1985 and is an American citizen. He was largely raised grew in the suburbs of Seattle, Washington and graduated from Inglemoor High School in 2003. He received his Bachelors of Science degree from Brigham Young University-Idaho, Rexburg, Idaho in 2009. While there he studied psychology with a minor in organizational communications, graduating magna cum laude. He went on to receive a Master of Science degree from Brigham Young University, Provo, Utah in 2011. Shortly after he attended Virginia Commonwealth University to pursue his doctoral degree in clinical psychology. He formally entered doctoral candidacy in March of 2014 and defended his dissertation in February 2016. He is completing his pre-doctoral internship in clinical psychology at the Salt Lake City Veterans Affairs Medical Center.