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An Exploratory Study of Biopsychosocial Factors Related to Chronic Pain Treatment Selection

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Abstract

The biopsychosocial model argues multiple biological, psychological, and social factors influence the experience, development, and management of chronic pain. The relations between pain intensity, pain interference, substance use, personality, depression, pain attitudes, pain catastrophizing, coping and social support were explored in a sample of 86 new pain treatment patients. An Exploratory Factor Analysis (EFA) revealed four underlying factors that explained 55.55% of the variance: *psychological factors* (25.34% variance), *daily functioning* (15.82% variance), *control* (7.63% variance), and *substance use/support* (6.57% variance). Logistic regression analyses were conducted to identify the predictive value of the identified factors for current and future chronic pain treatment (0 = noninvasive vs. 1 = invasive). Results indicated no factor was related to current pain treatment; however, *control* was predictive of future pain treatment (β = -.04, Exp(β) = .97). Formal prediction models were built to identify unique associations to current and future pain treatment. General pain attitudes—including beliefs one should be cared for, negative emotions increase pain, pain can be cured, pain can be controlled, pain causes harm, pain makes one disabled, and medications are the best treatment— was predictive of current pain treatment (β = .80, Exp(β) = 2.22). Pain catastrophizing (β = -.04, Exp(β)= .96) and general pain attitudes (β = 1.01, Exp(β) = 2.75) were predictive of future chronic pain treatment. Our findings suggest that cognitive factors play an important role in chronic pain treatment selection. Future research should use a larger, more diverse sample size to make findings more generalizable. *Keywords:* chronic pain, biopsychosocial model, chronic pain treatment, pain catastrophizing, pain attitudes, depression, coping

An Exploratory Study of Biopsychosocial Factors Related to Chronic Pain Treatment Selection

According to the International Association for the Study of Pain (IASP, 2012), pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (p. 3). This definition highlights that pain is a subjective experience, incorporating biological, psychological, and cognitive factors. Chronic noncancer pain is defined as pain for more than 12 weeks past the expected healing time of an injury, or despite treatment, and can have either a known or unknown cause (IASP, 2012). A variety of chronic pain conditions exist, ranging from widespread pain to localized pain. Recent estimates suggest that chronic pain impacts approximately 11.2% of the adult population (Dowell, Haegerich, & Chou, 2016). Individual studies have found chronic pain affects anywhere between 2% and 40% of the general population, with prevalence rates increasing for those in nursing homes and those with chronic health conditions (Glajchen, 2001).

Multiple theories have been advanced to explain the development and maintenance of chronic pain. These theories vary in focus and scope, with some being narrower (e.g., *specificity theory of chronic pain*) and others more multifaceted and encompassing. At present, the most prominent multifaceted theory of pain is the *biopsychosocial model* of chronic pain. The biopsychosocial model describes chronic pain as both a disease and an illness, emphasizing the importance of biological, psychological, and social factors in the perception, development, and maintenance of chronic pain (Gatchel et al., 2007). The biopsychosocial model has influenced current understanding and treatment of chronic pain (Jensen & Turk, 2014). Within the biopsychosocial model, there are multiple biological (e.g., sex, genetics), psychological (e.g., cognitive and affective), and social (e.g., social support, socioeconomic status, etc.) factors that influence pain perception and impact chronic pain treatment response (Murphy et al., n.d.;

Jensen & Turk, 2014; Turk et al., 2008). The biopsychosocial model is best understood as a superordinate framework that is compatible with all physiological theories of pain.

The ways to address chronic pain are diverse and varied (Tompkins et al., 2017). The treatment decisions a chronic pain patient makes appear influenced by psychological and social factors, including cognitive beliefs, affective functioning, personality style, and environmental support. The treatments available for chronic noncancer pain patients range from noninvasive to invasive but all require some degree of patient engagement and involvement. At present, the most common method used to treat chronic pain is medication. Although there are a range of medications (i.e., opioids and nonopioids) available to treat chronic pain, many patients continue to complain about the lack of medication effectiveness (American Chronic Pain Association [ACPA], 2016).

There are numerous interventions to address chronic pain in addition to medication management. These can range from noninvasive psychosocial interventions that reside outside of the physical realm (e.g., cognitive behavioral therapy), noninvasive approaches that are physical in nature (e.g., physical therapy, transcutaneous electrical nerve stimulation [TENS], applying cold or heat, acupuncture and chiropractics) and invasive treatments, such as surgery, injections, and the insertion of spinal cord stimulators and pain pumps (Murphy et al., n.d.).

Factors Associated with Chronic Pain Perception

The biopsychosocial model posits a variety of biological, psychological, and social factors influence pain and has prompted research investigating the role and importance of theoretically related factors. This study examined several biological (e.g., sex, age), psychological (e.g., cognition, affect, personality, coping), and social (employment status, social

support) factors for their relation to one another and to pain treatment options. The focal factors studied were selected based on past research documenting their relation to the pain experience.

Biological factors

Sex differences. Investigation into sex differences in pain perception, experience, and tolerance, has suggested women may be at elevated risk for developing multiple chronic pain conditions compared to men (Fillingim, 2000). Women have demonstrated lower pain thresholds and less pain tolerance compared to men (Fillingim, 2000). Lower pain tolerance has emerged across various categories of pain as women tolerate less pressure pain and less thermal pain (Racine, Tousignant-Laflamme, Kloda, Dion, Dupuis, & Choiniere, 2012). However, such results have been challenged as overly simplistic given the varied nature of pain conditions –i.e., migraine headaches, tension headaches, fibromyalgia—each with a distinct pain profile (Fillingim, 2000; Greenspan et al., 2007). Those arguing against genuine sex differences in pain sensitivity point to methodological problems in pain threshold studies, such as not reporting sex, measuring pain sensitivity in only one sex, and using nonstandardized pain sensitivity measures (Berkley, 1997; Greenspan et al., 2007; Hashmi & Davis, 2014). Given such concerns, evidence for sex differences in pain experience and sensitivity appears best understood as existing for only certain types of pain (e.g., pressure and thermal pain) and pain measures (e.g., various sites of application, intensity, and duration of pain measure; Racine et al., 2012).

Age-related changes in pain perception. Studies assessing age-related changes in pain perception have produced mixed findings (Kivrak et al., 2016; Lautenbacher et al., 2017). Chronic pain appears pervasive in the older adult population, as persistent pain is estimated to impact approximately 60-75% of adults above the age of 65 years (Molton & Terrill, 2014). However, this does not appear to be due to a generalized increase in pain sensitivity among older

adults. El Tumi et al. (2017) conducted a meta-analysis of 12 studies, spanning 12 years, which examined age-related changes in pain sensitivity in healthy pain-free adults. The meta-analysis found that although pressure pain thresholds were lower in older adults compared to younger adults, no age-related differences emerged for heat pain thresholds. Further, results indicated that older adults may actually have decreased pain sensitivity as the average pain threshold increased in older individuals (>60 years) compared to younger individuals.

In contrast to the age-related changes seen for pain sensitivity thresholds, pain tolerance thresholds appear unchanged by age (Lautenbacher et al., 2017). Lautenbacher et al. (2017) conducted a meta-analysis of 40 studies across 70 years and found pain tolerance thresholds do not show substantial age-related changes. Nine studies revealed insignificant differences in pain tolerance thresholds between younger and older adults. Only pressure stimuli showed a significant age-related reduction in tolerance threshold; no age-related changes emerged for other stimuli (e.g., electrical, thermal). Further, the site of stimulation did not have an effect on age-related differences in pain tolerance. In summary, there appear to be some modest, stimuli-specific, but no generalized, age-related changes in pain tolerance.

Nonbiological factors associated with pain

Socioeconomic status. Research suggests a strong association between socioeconomic status (SES) and the pain experience (van Hecke et al., 2013). The prevalence of reported pain is higher in less affluent areas compared to more affluent areas (Davies et al., 2009; van Hecke et al., 2013). The reason for this association is likely multidimensional as pain has shown relations with a variety of specific correlates of lower SES—such as education level, employment, and financial stability. Several large scale, longitudinal studies have examined the relations between correlates of SES and pain (Dorner et al., 2011; Hagen et al., 2002). Results indicated that lower

education, lower income, and lower occupational status were all associated with markedly increased risk for development of pain and pain related disability. Overall, findings suggest that SES is not only related to pain intensity, but also disability caused by pain.

Cognitive factors. As noted, the experience of pain includes a cognitive component. Key cognitive factors associated with subjective pain are beliefs about pain, pain attitudes and illness perceptions, and propensity for catastrophizing. Cognitive factors have been implicated in why people with similar conditions and health problems have different perceptions and cognitive representations of their illness (Petrie et al., 2007). Multiple studies have found that patient beliefs about their pain, about their ability to control their pain, and about their level of disability, are related to pain intensity and psychological and physical functioning (Jensen et al., 1999; Turner et al., 2000; Turk & Okifuji, 2002), as well as symptom chronicity and disability (Moss-Morris, 2011).

Pain attitudes and beliefs. Although highly related constructs, pain attitudes—or patients' feelings toward chronic pain and their chronic pain experience—and pain beliefs—or the information that patients possess relating to pain that impacts their behavior—are distinct (Tait & Chibnall, 1997). Research has suggested that stoic and cautious attitudes toward pain are linked to underreporting of pain and failure to seek help in older adults (Cornally & McCarthy, 2011), whereas positive attitudes related to one's chronic pain condition, current status, and future status can foster resilience (Karoly & Ruehlman, 2006).

Pain catastrophizing. Pain catastrophizing has been defined as the magnification of the threat value of pain and has been conceptualized as an automatic thought or appraisal (Quartana et al., 2009; Turner et al., 2000). Several studies have found adverse outcomes related to catastrophizing including more pain sensitivity, pain severity, pain interference, pain behaviors,

depression symptoms, poorer pain coping, and overall disability (Edwards et al., 2006; Quartana et al., 2009). Further, reduction in catastrophizing was positively associated with psychological functioning, reduced pain interference, and resilience in chronic pain patients (Karoly & Ruehlman, 2006; Nieto et al., 2012).

Depression. A robust relation between chronic pain and depression has emerged over time and across numerous studies (Reynolds et al., 2018). According to the National Comorbidity Survey Replication (NCS-R), up to 54% of pain patients have comorbid depression and up to 50% report anxiety (Gadermann et al., 2012). One conceptualization of the interconnection between depression and pain is the *depression-pain syndrome*. This syndrome holds that chronic pain and depression exacerbate each other and respond to similar treatments (Wong & Anitescu, 2017). Additionally, affect appears to influence patients' perception of their pain. For example, patients struggling with negative affect are more likely to make cognitive errors (e.g., perception of control) and negative appraisals (e.g., catastrophizing pain experience), resulting in disability (Wong & Anitescu, 2017). Furthermore, locus of control—or one's perception of control over a situation— is related to negative affective states such as depression and anxiety. Individuals with an external locus of control have higher depression and anxiety compared to those with an internal locus of control (Wong & Anitescu, 2017).

Personality factors. Research suggests that personality characteristics may influence the way an individual copes and deals with chronic pain. The *Five Factor Model (FFM)* of personality suggests that personality is dimensional and comprised of stable patterns of thoughts, feelings, and behaviors (McCrae & Costa, 2013). The FFM posits five core personality dimensions or factors: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism.

The relations between the big-five personality dimensions and chronic pain are mixed and vary depending on the specific chronic pain condition examined and the way personality is measured. Within the chronic pain literature, neuroticism and extraversion are the most researched. An appealing idea that has generated a significant amount of interest is that there may exist a "pain personality" and individuals with chronic pain possess a unique personality profile compared to non-chronic pain sufferers (Gustin et al., 2015). Within this framework, neuroticism has received the most attention and support in the literature as an important component of a potential pain personality. Greater neuroticism has been found to be related to increased pain reactivity, use of passive pain coping, catastrophizing, depression, pain anxiety, and lower quality of life in those with chronic pain (Kadimpati et al., 2015; Ramírez-Maestre et al., 2003). When examining chronic pain treatment response, low neuroticism has emerged as related to better treatment response and outcomes compared to those with high neuroticism (Koh et al., 2013).

The second most investigated big-five personality factor in relation to chronic pain treatment is extraversion. Higher extraversion is related to being active, social, and energetic, which can impact chronic pain management (McCrae & Costa, 2013). In those with chronic pain, higher extraversion has been associated with increased vitality and improved social functioning (Suso-Ribera & Gallardo-Pujol, 2016). Higher extraversion is also predictive of adaptive, active coping styles, such as reaching out for social support, in individuals with chronic prostatitis and chronic pelvic pain and with improved pain management (Koh et al., 2013; Phillips & Gatchel, 2000; Ramírez-Maestre et al., 2004).

Social factors. Research suggests that social factors can impact the development and maintenance of chronic pain and individuals' response to treatment (Murphy et al., n.d; Turk et

al., 2016). Levels of social support and the response of social networks to the communication of pain and suffering have received the most attention in the literature. Social support has been defined as actual or perceived resources and support from others (López-Martínez et al., 2008). Higher levels of social support have been found to promote better adjustment, less pain, and less distress in those with chronic pain (López-Martínez et al., 2008). Additionally, social support is related to less pain-related disability (Evers et al., 2003; Matos et al., 2017).

Factors Associated with Treatment Selection

Cognitive factors

The type of treatment selected by an individual experiencing chronic pain has been associated with a variety of cognitive factors, such as beliefs about treatment and beliefs about medication. As noted, pharmacologic treatment is a first line treatment approach endorsed by the American Pain Society and American Academy of Pain Medicine (Dowell et al., 2016). Clarke and Iphofen (2007) interviewed eight chronic pain patients to better understand the influence of the belief of one's apparent ability/inability to manage one's chronic pain. They found that patients who held thoughts about curing their pain would visit several hospitals and specialists seeking a cure. In this same study, they also found a self-fulfilling prophecy theme in which patients who were actively seeking a pain cure would behave in a way that confirmed the expectancy of their physicians. For example, one patient was told by surgeons that she would immediately depend on a wheelchair if she got surgery. Although this patient did not undergo a procedure, she started to use her wheelchair to assist with her mobility. These findings suggest that one's beliefs can impact one's chronic pain management approach.

Coping strategies

The way an individual copes with chronic pain has been related to treatment choices and outcomes. Coping strategies for pain management can be classified as active or passive, which can further be understood as adaptive or maladaptive. As described by Brown and Nicassio (1987) active coping strategies are tactics used by chronic pain patients to deal with their pain using available resources to continue functioning despite the pain. In contrast, passive coping strategies are tactics used by a chronic pain patient to surrender control of the pain to others or to allow the pain to interfere with functioning. A general difference between active and passive coping strategies is that active coping relies on internal resources whereas passive coping relies on external resources to control and manage pain (Higgins et al., 2015). Overall, active coping strategies are generally classified as adaptive and related to multiple positive outcomes. Passive coping strategies, on the other hand, are generally maladaptive and related to negative outcomes (Snow-Turek et al., 1996). Some examples of active coping include exercise, over-activity relaxation strategies (Broderick et al., 2014; Murphy et al., n.d.). Some examples of passive coping include guarding, resting, under-activity (Murphy et al., n.d.). Another example of passive coping is catastrophizing when it has been learned as a coping style, which has been been related to increased pain severity and disability (Boothby et al., 2004; Smith et al., 2015). Passive coping has been related to depression and disability (Cook et al., 2006; Vlaeyen & Linton, 2012; Wong et al., 2015). Active coping, on the other hand, has been related to reduced pain intensity, enhanced coping with pain, increased self-efficacy for controlling pain, reduced pain interference, and reduced use of pain medication (Broderick et al., 2014).

History of substance abuse

Patients' histories of substance use and abuse have shown a robust relation to pain treatment choices (Michna et al., 2004; Schieffer et al., 2005). A class of key behaviors, commonly referred to as drug-seeking behaviors, have been observed in individuals addicted to pain medication. Correctly identifying problematic drug-seeking behaviors is complex as many of these behaviors overlap with passive coping strategies, including resistance to change in therapy, aggressive complaining about needing medication and requesting specific medication(s). As these behaviors can be present in non-addicted patients, caution is required when interpreting their significance and better predictors of medication abuse are needed (Schieffer et al., 2005). A risk factor for problematic pain medication use is a history of other substance abuse, both at the personal and family levels. Specifically, research indicates the risk of opioid misuse in chronic pain patients who do not have a history of abusing substances is low compared to patients who have a substance abuse history (Michna et al., 2004; Schieffer et al., 2005). Such findings suggest substance use history could potentially be related to the treatment decision-making process.

Current Study

Despite what is known about the correlates of pain and pain treatment outcomes, it remains unclear why a chronic pain patient selects one treatment approach over another—particularly, why some patients may opt for passive, noninvasive approaches only, such as medication, while others may pursue invasive treatment options as part of a comprehensive plan. The present study examined how several biopsychosocial factors associated with chronic pain influence the decision-making process for individuals with chronic, noncancer, pain when selecting a treatment approach. Specifically, this study examined how pain intensity, pain

interference, pain attitudes, pain catastrophizing, depression, personality traits (e.g., neuroticism, extraversion), social support, coping, and substance use influence treatment selection, with the goal of identifying easy to assess factors that differentiate between individuals who select a non-invasive approach (e.g., medication and/or TENS unit) versus an invasive approach (e.g., injections, block, spinal cord stimulation, targeted drug delivery (e.g., pain pump), and vertebral augmentation).

This study had two purposes: one theoretical and one applied. The theoretical purpose was to understand the overall relations between the focal constructs, to identify any underlying or core constituent factors and to determine how these latent factors are related to treatment choice. The applied purpose was to use model building techniques to investigate how each focal construct is related to treatment choice and identify which carry unique predictive information regarding treatment choice. Once identified, variables with unique contributions to treatment choice could be used to create a screening tool. Based on previous findings, a number of interrelations were anticipated. Specifically, pain attitudes were expected to be positively related to pain interference; pain catastrophizing was expected to be positively related to pain interference, and passive coping; depression was expected to be positively related to pain interference, passive coping, and pain catastrophizing and inversely related to active coping and social support. Regarding personality, neuroticism was expected to be positively related to pain interference and inversely related to active coping. Extraversion was expected to be positively related to active coping. Finally, regarding substance use, problematic substance use was expected to be positively related to passive coping and inversely related to active coping and general substance use (past and present; average drinks/week; weekly marijuana use, tobacco use) was expected to be positively related to pain catastrophizing.

Method

Participants

Participants were recruited from a private pain clinic—hereafter referred to as the *partner clinic.* Study inclusion criteria were being at least 18 years of age, receiving treatment for at least one non-cancer chronic pain condition, and presenting to the partner clinic for an initial appointment. Study exclusion were cancer or headache diagnoses and those presenting to the partner clinic solely for surgical intervention. Cancer patients were excluded given evidence that the chronic pain related to cancer is associated with a unique set of environmental and personal correlates (Zaza & Baine, 2002). Headache pain patients and those seeking solely surgical intervention were excluded, as these patients were not choosing from a full array of treatment approaches and this study was interested in understanding treatment selection in patients who had the opportunity to select a pharmacologic, minimally invasive, or maximally invasive treatment from the partner clinic.

A total of 501 potential participants were invited to participate and 91 new chronic pain patients consented to enter the study. Of the 91, five were excluded from data analyses because they reported cancer diagnoses. The final sample included 86 participants. The sample was comprised of 51 females and 35 males with a mean age of 57.95 years (range: 25 – 82). The sample was predominantly White (93%). The majority of the participants endorsed musculoskeletal pain (70.9%). Nearly all participants (96.5%) were using some form of pain medication (including prescription and OTC) for their chronic pain at study entry. Detailed participant information is provided in Table 1 and Table 2.

Measures

Demographic and background information

Demographic information (e.g., age, sex, ethnicity, education level, employment status, income level) was collected directly from participants via a survey instrument.

Chronic pain treatment selection. Participants were asked three questions on the background questionnaire to assess their chronic pain treatment preferences. To measure *past* treatments, participants were asked, "what chronic pain treatments have you used in the past?" To measure *current* pain treatments, participants were asked, "what chronic pain treatments are you currently using?" Current chronic pain treatments reflected treatments participants were engaging at the point of initiating their treatment at the partner clinic as this information was collected prior to their first visit. These treatments may have been obtained from by a previous provider or were treatments that did not need a medical provider (e.g., OTC medication). Future chronic pain treatment was measured with the question, "what chronic pain treatments are you *willing to try in the future*?" For each question, participants were given the option to select the from following treatments: opioid medication, non-opioid medication, over-the-counter (OTC) medication, injections, spinal cord stimulator, intrathecal pump, surgery, physical therapy, TENS unit, chiropractics, acupuncture, psychological therapy, yoga/tai chi, biofeedback, relaxation training, and other. Current chronic pain treatment strategies that required a medical provider were confirmed through the medical record. There was 100% agreement between self-report and the medical record for current chronic pain treatment strategies. If there was disagreement, the participants self-report would have been used. Future treatment choice(s) were coded as invasive ("1") or noninvasive ("0"). Invasive choices included injections, block, spinal cord stimulation, targeted drug delivery (e.g., pain pump), and vertebral augmentation; noninvasive choices

included medication and TENS units. Future treatment choices were limited to only those offered by the partner clinic. The coding yielded two dichotomous outcome variables: current treatment (0 = noninvasive/1 = invasive) and future treatment (0 = noninvasive/1 = invasive). Participants who reported use of/interest in both a noninvasive (e.g., medication) and invasive treatment option were coded as "invasive." Additionally, information about the target pain condition was extracted from the medical record.

Pain intensity

Pain intensity was measured using the Numeric Pain Rating Scale (NPRS). The NPRS is a unidimensional measure of pain intensity typically used in adults. The NPRS assesses pain using an 11-point scale, ranging from 0 = *no pain* to 10 = *worst pain imaginable*. The NPRS has *prior-24 hours* and *average* pain intensity versions. For this study, the average pain intensity version was used. The NPRS has demonstrated good construct validity as it has shown sensitivity to changes in pain intensity ratings (Williamson & Hoggart, 2004) and positive correlations with other pain intensity measures, such as the Visual Analogue Scale (r = .94).

Pain interference

Pain interference was measured using one item from the three item PEG—(P)ain intensity, interference with (E)njoyment of life, and interference with (G)eneral activity; Krebs et al., 2009. The item used was the (G) item. Each item of the PEG has an 11-point scale, ranging from 0 = *does not interfere* to 10 = *completely interferes*. The PEG asks about pain interference during the past week. In a chronic pain sample, the PEG has shown good reliability (α = .73 and α = .89) and construct validity (r = .60 - .95; Krebs et al., 2009).

Substance use

Alcohol, marijuana, and tobacco use was measured. Alcohol was assessed using the following questions:

1) How many days a week do you consume alcohol?

2) How many standard drinks (a standard drink is 5 oz of wine, 12 oz of beer or ½ oz of liquor) do you consume during a typical drinking occasion?

3) What is your drink of choice?

Total weekly alcohol consumption was calculated by multiplying the number of consumption days/week by number of standard weeks.

Potentially problematic alcohol use was assessed using the CAGE (Ewing, 1984). The CAGE is a 4-item screener that uses a *have you ever* prompt to examine alcohol use patterns. The four questions are*: have you ever…*

1) attempted to **C**ut down on drinking
2) been **A**nnoyed by others criticizing your drinking
3) felt **G**uilty about your drinking
4) needed to drink first thing in the morning (e.g., using alcohol as an **E**ye-opener)

Items were answered either 'yes' or 'no' and were scored 1 for yes and 0 for no. Scores of 2 or greater are reflective of possible alcohol use problems. The CAGE was used in conjunction with quantity/frequency information to assess how alcohol use patterns affect pain treatment choices.

Marijuana use was assessed using the following question: 1) how many days a week do you use marijuana in any form?

Tobacco use was assessed using the following question 1) are you a smoker? Yes/ No.

Personality

Personality was measured using the Big Five Inventory (BFI; John et al., 1991). The BFI is a 44-item measure examining the prototype definitions of the Big Five personality factors. The BFI uses short phrases based on trait adjectives for each factor. The BFI has five factor scales that contain eight to ten items each. The factor scales are: 1) Extraversion—a sample item is "Is talkative"; 2) Agreeableness—a sample item is "Is helpful and unselfish with others"; 3) Conscientiousness—a sample item is "Does a thorough job"; 4) Neuroticism—a sample item is "Is depressed, blue"; and 5) Openness—a sample item is "Is original, comes up with new ideas." Participants indicated their agreement with each statement on a 5-point Likert-type scale, ranging from 1 *(disagree strongly*) to 5 (*agree strongly*). In the current sample the BFI demonstrated adequate to good internal consistency reliability across all scales: BFI total score $\alpha = .82$; Neuroticism $\alpha = .86$; Openness to Experience $\alpha = .86$; Agreeableness $\alpha = .77$; Conscientiousness $\alpha = .77$; and Extraversion $\alpha = .82$.

Depression

Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item scale assessing depressive symptomology in the general population. Questions were answered on a 4-point Likert-type scale from 0 (*rarely or none of the time, less than 1 day*) to 3 (*most or all of the time, 5-7 Days*). Items are summed to create a total score, which can range from 0 to 60, with higher scores indicating more depressive symptoms. The CES-D contains four subscales: 1) depressed affect; 2) positive affect; 3) somatic and retarded activity; 4) and interpersonal. Either full scale or subscale scores can be used. This study used the full-scale score.

The CES-D has demonstrated good reliability and validity (Radloff, 1977). In the current study, the CES-D demonstrated excellent internal consistency as α = .91.

Pain attitudes

Pain attitudes was measured using the Survey of Pain Attitudes – Brief (SOPA-B; Tait & Chibnall, 1997) The SOPA-B is a brief version of the SOPA (Jensen et al., 1987) and contains 30 items assessing patient attitudes and beliefs about pain. Questions were answered on a 5-point Likert-type scale from 0 (*very untrue*) to 4 (*very true*). The SOPA-B has seven distinct subscales and does not generate an overall or summary score: 1) Solicitude, which contains five items. A sample item is "When I am hurt, I want my family to treat me better"; 2) Emotionality, which contains four items. A sample item is "Depression increases the pain I feel"; 3) Cure, which contains five items. A sample item is "My physical pain will never be cured"; 4) Control, which contains five items. A sample item is "I know for sure I can learn to manage my pain"; 5) Harm, which contains four items. A sample item is "Exercise can decrease the amount of pain I experience"; 6) Disability, which contains four items. A sample item is "I can do nearly everything as well as I could before I had a pain problem"; and 7) Medication, which contains three items. A sample item is "Medicine is one of the best treatments for chronic pain." Subscale scores are calculated by averaging the constituent items; higher scores reflect stronger beliefs. Although specific cut-off scores for problematic vs. non-problematic pain attitudes have not been established, lower scores are considered to be more adaptive (de Mattos Pimenta et al., 2009). Although the SOPA-B does not generate an overall or summary score, one was created in this study due to power reasons. The SOPA-B has demonstrated adequate-to-good reliability for six of the seven subscales (Solicitude α= .83, Emotionality α = .80, Cure α= .72, Control α= .70, Harm α = .71, Disability α= .70; the exception is Medication α = .56) and good construct validity

(Tait & Chibnall, 1997). For the current sample the subscale α values ranged from poor-to-excellent: Solicitude (α = .89), Emotionality (α = .92), Cure (α = .76), Control (α = .63), Harm (α = .76), Disability (α = .45) and Medication (α = .78).

Pain catastrophizing

Pain catastrophizing was measured using the Pain Catastrophizing Scale (PCS; Sullivan et al., 1995). The PCS is a 13-item measure assessing attentional focus on pain-related thoughts, exaggeration of the threat value of pain, and helplessness to cope with pain. Questions were answered on a 5-point Likert-type scale from 0 (*not at all)* to 4 (*all the time*). The PCS has three subscales: 1) rumination, which contains four items. A sample item is "I keep thinking about how badly I want the pain to stop"; 2) magnification, which contains three items. A sample item is "I wonder whether something serious may happen"; and 3) helplessness, which contains five items. A sample item is "I feel I can't go on." Items are summed to calculate a total score, which can range from 0-52. A total score $\geq$ 30 (75th percentile) is considered clinically relevant levels of catastrophizing and associated with high risk for chronicity. A score between the 50th and 75th percentiles is considered moderate risk for the development of chronicity. A score below the 50th percentile is considered low risk for chronicity. The PCS has demonstrated good overall internal consistency (α = .87), good subscale consistency (α = .87, .60, and .79 for rumination, magnification, and helplessness, respectively) and good discriminant validity as PCS scores have distinguished between catastrophizers and non-catastrophizers (Sullivan, et al., 1995). This study used the full-scale score. In the current study, the PCS demonstrated excellent internal consistency indicated by α = .94.

Coping

Pain coping was measured using the Vanderbilt Pain Management Inventory (VPMI; Brown & Nicassio, 1987). The VPMI is an 18-item self-report measure examining active and passive coping strategies. Questions were answered on a 5-point Likert-type scale from 1 (*never)* to 5 (*very frequently*). The VPMI is comprised of two subscales: active coping and passive coping. Constituent items are summed to calculate subscale scores. The active coping subscale includes seven items and scores can range from 7 to 35. A sample item is "doing something you enjoy." Higher scores on the active coping subscale is indicative of engaging in more active coping strategies. The passive coping subscale includes 11 items and scores can range from 11 to 55. A sample item from the passive subscale is "praying for relief." Higher scores on the passive coping subscale is indicative of engaging in more passive coping strategies. The VPMI has demonstrated adequate internal consistency for the active coping subscale ($\alpha = .71$) and good internal consistency for the passive coping subscale ($\alpha = .82$). This study used both the active coping and passive coping subscales. In the current study, the VPMI demonstrated excellent internal consistency the passive subscale ($\alpha = .91$) and adequate internal consistency for the active subscale ($\alpha = .79$).

Social support

Social support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988). The MSPSS is a 12-item self-report measure examining subjective social support. Questions were answered on a 7-point Likert-type scale from 1 (*very strongly disagree*) to 7 (*very strongly agree*). The MSPSS produces both a total score and three subscale scores, which specify the source of social support. The Family subscale consists of four items. A sample item is "my family really tries to help me." The Friends subscale consists of

four items. A sample item is "I can count on my friends when things go wrong." The Significant Other subscale consists of four items. A sample item is "There is a special person with whom I can share my joys and sorrows." Scores are calculated by summing items and higher scores are indicative of greater levels of social support. The MSPSS has demonstrated good overall (α = .88) and subscale reliability: significant other (α = .91), family (α = .87), and friends (α = .85), as well as good test-retest reliability after 2 to 3 months overall (Zimet et al., 1998). In the current study, the MSPSS total score was used and demonstrated excellent internal consistency (α =.91).

Procedure

Human subjects approval was obtained from the Institutional Review Board (IRB) of Xavier University (See Appendix A). The researcher was National Institute of Health Human Participants Protection certified. In order to have access to the electronic medical record, the lead investigator completed HIPAA training at the partner clinic prior to data collection. Potential participants were recruited by mail after they scheduled their initial appointment at the partner clinic. The partner clinic provided the lead researcher with the name and address of all new clients. The lead researcher mailed packets containing informed consent documentation and study measures to these potential participants. The first page of the packet contained a brief letter stating that the measures were for a research study to examine factors related to chronic pain management, that all information would remain confidential, responses would only be viewed by study personal (not pain clinic staff) and would not be entered into the medical record. Per the request of the lead medical doctor at the partner clinic, the letter explicitly stated that all responses would not be used for diagnosis or treatment planning at the clinic. Participants were informed that their participation was optional. See Appendix B.

Following informed consent documentation, those who decided to enter the study completed the demographic questionnaire, followed by the PNRS, PEG, substance use patterns, CAGE, BFI, CES-D, SOPA-B, PCS, VPMI, and MSPSS. All measures were precoded with a unique participant number. Participants did not record their name on any measure. After completion, participants were instructed to bring the completed measures to the partner clinic at their first appointment (n = 88); following the emergence of the COVID-19 pandemic and the partner clinic's transition to telehealth, return postage was included and participants were instructed to mail the completed packet to the lead investigator (n =3).

A master list was created for tracking purposes only. The master list included the precoded participant number associated with each potential participant and the potential participant's name and birth date to allow access to the medical record for those who opted to enter the study. When a participant packet was received, the medical record information was extracted. The master list was kept a locked file on a password protected computer and destroyed after data collection was completed.

The practice administrator informed the lead researcher when data packets were turned in at the partner clinic. The practice administrator kept the sealed packets in a locked cabinet at the partner clinic for the lead investigator's collection. Once collected, the lead investigator stored the physical packets in a locked office.

Analytic Plan

This study had two purposes: one theoretical and one applied. The theoretical purpose was to understand the overall relations between the focal biopsychosocial constructs being assessed, to identify any underlying or core constituent factors, and to investigate how the identified factors are related to treatment choice. The applied purpose was to investigate how

each focal biopsychosocial construct assessed is related to treatment choice and which carry the most predictive information regarding treatment choice.

Purpose 1: To explore the relations between several biopsychosocial factors, an exploratory factor analysis (EFA) was conducted to identify underlying or latent constructs theorized to be related to chronic pain. The EFA explored the relations between the following variables via correlation matrix: pain intensity (Numeric Pain Rating Scale: NPRS), pain interference (PEG), pain attitudes (SOPA-B; Tait & Chibnall, 1997), pain catastrophizing (PCS; Sullivan et al., 1995), depression (CES-D; Radloff, 1977), personality (BFI; John et al., 1991), substance use (CAGE; Ewing, 1984; average drinks/wk; marijuana use, tobacco use), pain coping (VPMI; Brown & Nicassio, 1987), and social support (MSPSS; Zimet et al., 1988).

Purpose 2: Both the latent factors identified by the EFA and each focal construct selected *a priori* were assessed for their relation to treatment selection using logistic regression (dichotomous outcome = invasive vs noninvasive treatment). The relations with treatment choice for each construct was tested in a systematic manner and two parallel formal prediction models were built predicting: 1) current treatment selection and 2) future treatment selection. First, univariate regression analyses were conducted. Specifically, tests of pain intensity (NPRS), pain interference (PEG), pain attitudes (SOPA-B: Control and Disability subscales; total score), pain catastrophizing (PCS), depression (CES-D), personality (BFI: Neuroticism and Extraversion subscales), substance use (CAGE; average drinks/week; marijuana use), coping (VPMI: Active Coping and Passive Coping subscales), and social support (MSPSS) were conducted. Following univariate tests, two parallel predication models were built using the same steps. Predictors that met a relaxed selection criteria ($p < .25$; Yong & Pearce, 2013) were retained. All retained predictors were entered as a set. Predictors were examined for their relation to outcome. The

model was refined by removing the variable with the lowest relation with outcome and then retested until only significant predictors remained.

Results

Prior to data analyses, the data were screened and assessed for normality. First, a missing data analysis was conducted to determine if missing data occurred at random. Less than 2% of the data were missing. Little's MCAR test was significant (chi-square < .01, df = 6567, Sig = 1.00), indicating missing data occurred at random. An expectation maximization algorithm was utilized to replace the missing values.

Each continuous measure was analyzed for normality using the Shapiro-Wilk Test. The SOPA-B Cure subscale ($W = .97$, $p = .07$), SOPA-B Control subscale ($W = .99$, $p = .15$), CES-D ($W = .98$, $p = .21$), VPMI-Passive Coping ($W = .99$, $p = .48$), VPMI-Active Coping ($W = .97$, $p = .08$), MSPSS ($W = .98$, $p = .18$), BFI-Openness ($W = .98$, $p = .35$), BFI-Conscientiousness ($W = .99$, $p = .46$), and BFI-Extraversion ($W = .98$, $p = .40$) were determined to be normally distributed. Deviations from normality occurred for the CAGE ($W = .49$, $p < .01$), SOPA-B Solicitude subscale ($W = .93$, $p < .01$), SOPA-B Emotionality ($W = .93$, $p < .01$), SOPA-B Harm ($W = .95$, $p < .01$), SOPA-B Disability ($W = .93$, $p < .01$), SOPA-B Medication ($W = .88$, $p < .01$), PCS ($W = .97$, $p = .03$), BFI-Neuroticism ($W = .96$, $p = .01$), BFI-Agreeableness ($W = .96$, $p = .01$), Average Pain Intensity ($W = .92$, $p < .01$), Pain Interference ($W = .87$, $p < .01$), Alcohol Use ($W = .44$, $p < .01$), and Marijuana Use ($W = .21$, $p < .01$). Upon further investigation, SOPA-B Emotionality, SOPA-B Harm, SOPA-B Solicitude, SOPA-B Disability, SOPA-B Medications, BFI-Neuroticism, BFI-Agreeableness, Average Pain Intensity, and PCS, appeared to be normally distributed based on the calculation of skewness/std. error of skewness being <3.0 (Cramer & Howitt, 2004). As anticipated, the substance use variables all displayed a

positive skew. Specifically, the CAGE, weekly alcohol use, and weekly marijuana use displayed positive skews, meaning more participants reported lower levels of potentially problematic alcohol use, general alcohol use, and general marijuana use. Pain Interference displayed a negative skew, meaning more participants reported higher levels of pain interferences.

Preliminary analyses

The descriptive properties of each variable was assessed. Table 3 contains summary information. As can be seen, participants reported low frequency of potentially problematic substance use, low levels of extraversion, and low levels of active coping. Participants reported high levels of pain catastrophizing, passive coping, agreeableness, conscientiousness, and social support. Participants reported low to moderate levels of pain attitudes. Participants reported moderate levels of depression.

Theoretical Analyses

Primary Hypotheses

A total of 14 formal hypotheses were tested by examining the correlation matrix associated with the exploratory factor analyses. Results indicated eight hypotheses were supported. See Table 4 for specific values.

Hypotheses related to Cognition and Affect.

Hypothesis 1. It was hypothesized that there would be significant positive relations between pain attitudes (SOPA-B) and pain interference (PEG). The hypothesis was supported for the following SOPA-B subscales: Solicitude, Harm, Disability, and Medication.

Hypothesis 2. It was hypothesized that there would be a significant positive relation between pain catastrophizing (PCS) and pain interference (PEG). The hypothesis was supported.

Hypothesis 3. It was hypothesized that there would be a significant positive relation between pain catastrophizing (PCS) and passive pain coping (VPMI – Passive Coping subscale). This hypothesis was supported.

Hypothesis 4. It was hypothesized that there would be a significant positive relation between depression (CES-D) and pain interference (PEG). This hypothesis was supported.

Hypothesis 5. It was hypothesized that there would be a significant inverse relation between depression (CES-D) and active pain coping (VPMI – Active Coping subscale). The hypothesis was not supported.

Hypothesis 6. It was hypothesized that there would be a significant positive relation between depression (CES-D) and passive pain coping (VPMI – Passive Coping subscale). The hypothesis was supported.

Hypothesis 7. It was hypothesized that there would be a significant positive relation between depression (CES-D) and pain catastrophizing (PCS). The hypothesis was supported.

Hypothesis 8. It was hypothesized that there would be a significant inverse relation between depression (CES-D) and social support (MSPSS). The hypothesis was supported.

Hypotheses related to Personality

Hypothesis 9. It was hypothesized that there would be a significant positive relation between neuroticism (BFI – Neuroticism subscale) and pain interference (PEG). This hypothesis was not supported.

Hypothesis 10. It was hypothesized that there would be a significant positive relation between extraversion (BFI –Extraversion subscale) and active pain coping (VPMI – Active Coping subscale). This hypothesis was not supported.

Hypothesis 11. It was hypothesized that there would be a significant inverse relation between neuroticism (BFI - Neuroticism subscale) and active pain coping (VPMI – Active Coping subscale). This hypothesis was not supported.

Hypotheses related to Substance Use.

Hypothesis 12. It was hypothesized that there would be a significant positive relation between problematic substance use (CAGE) and passive pain coping (VPMI – Passive Coping subscale). The hypothesis was not supported.

Hypothesis 13. It was hypothesized that there would be a significant inverse relation between problematic substance use (CAGE) and active pain coping (VPMI – Active Coping subscale). The hypothesis was not supported.

Hypothesis 14. It was hypothesized that there would be a significant positive relation between substance use (past and present; average drinks/week; marijuana use, tobacco use) and pain catastrophizing (PCS). This hypothesis was not supported for alcohol use and marijuana use, but was supported for tobacco use.

An EFA using principal component analysis and Varimax rotation was conducted on the 23 *a priori* focal constructs to identify underlying latent factors. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was .73, which indicated that the EFA was useful at identifying underlying factors. Bartlett's Test of Sphericity was significant (chi square = 886.03, $df = 231$, $p < .01$), indicating that the EFA was useful. A number of criteria were used to determine the number of factors to rotate. First, the number of possible factors associated with an Eigenvalue of greater than one was examined. This approach suggested six underlying factors. However, examination the scree plot indicated that four factors had been identified. A four factor solution was rotated and yielded four interpretable factors.

Factor one represented psychological factors and accounted for 25.34% of the item variance; factor two represented daily functioning and accounted for 15.82% of the item variance; factor three represented control and accounted for 7.63% of the item variance; and factor four represented substance use/support and accounted for 6.57% of the variance. As seen in Table 5, four variables loaded on more than one factor.

Applied Analyses

Predictor variables comprised of the items associated with each of the four factors (psychological factors, daily functioning, control, and substance use/support) were created. Logistic regression was used to examine their zero-order relation to current and future chronic pain treatment selection. Results indicated that no factor was predictive of current chronic pain treatment selection (see Table 6). However, factor 3 (control) was predictive of future chronic pain treatment selection ($p = .02$). Those who had higher scores on factor 3 (control) were less likely to use invasive treatment. Table 7.

Formal modeling was used to create a prediction model and to identify the unique predictive value of demographic variables and focal constructs. First, univariate regression analyses were conducted to examine the relation between each variable and current treatment selection. Using a relaxed rejection criteria ($p < .25$), the following variables were retained: employment status ($p = .07$), CAGE ($p = .08$), SOPA – Control subscale ($p = .16$), SOPA – Total ($p = .07$), marijuana use ($p = .25$), and PCS ($p = .24$). See Appendix C for results of all univariate tests.

Second, all retained predictors were entered as a set. Model 1 included employment status (dichotomized to employed/not employed), CAGE, weekly marijuana use, PCS, SOPA – Control, and SOPA – Total. (Appendix E). SOPA - Control was removed from the model and the model was refit. Model 2 included employment status, CAGE, weekly marijuana use, PCS Total, and SOPA – Total (Appendix F). Weekly marijuana use was removed from the model and the model was refitted. Model 3 included employment status, CAGE, PCS Total, and SOPA – Total (Appendix G); Employment status was removed from the model. Model 4 included CAGE, PCS, and SOPA – Total (Appendix H). PCS was removed from the model. Model 5 included CAGE and SOPA - Total (Appendix I). Finally, CAGE was removed from the model, leaving SOPA - Total, which showed marginal significance ($p = .07$). See Table 8.

When examining the relation between focal constructs and future treatment selection, the following constructs were retained for model building: employment status ($p = .08$), weekly marijuana use ($p = .15$), PCS total ($p = .21$), VPMI – Active Coping subscale ($p = .16$), and SOPA – Total ($p = .20$). See Appendix D.

Again, all retained variables were entered as a set and removed based on relation to outcome. Model 1 included employment status, weekly marijuana use, PCS total, VPMI – Active

Coping, and SOPA – Total (Appendix J). Weekly marijuana use was removed from the model and the model was refitted. Model 2 included employment status, PCS total, VPMI – Active, and SOPA – Total (Appendix K). VPMI – Active was removed and the model was refitted. Model 3 included employment status, PCS total, and SOPA – Total (Appendix L). Employment status was removed and the model was refit. Model 4 included PCS total and SOPA – Total; both variables displayed a unique, significant association with outcome. Those who scored higher on pain catastrophizing were less likely to use invasive treatments. Those who scored higher on SOPA – Total were more likely to use invasive treatment. See Table 9.

Discussion

Chronic pain presents as multifaceted and complex and appears best understood using a wide lens—such as that provided by the biopsychosocial model (Gatchel et al., 2007). This study examined several biological, psychological (e.g., personality traits, cognitive, affective), and social factors (e.g., socioeconomic status, employment status, coping, social support) and their relation to chronic pain treatment selection (dichotomized as invasive vs. non-invasive). Non-invasive treatment was comprised of medication use (opioid and non-opioid) and/or TENS unit as these were the two non-invasive treatment options available to participants at the partner clinic. Invasive treatment was comprised of interest in at least one invasive approach, with or without concomitant noninvasive (e.g., medication) treatment. Additionally, formal model building techniques were used to better understand which biopsychosocial factors were predictive of chronic pain treatment selection.

Sample Characteristics

The study sample, although modest in size, appeared appropriate for examining biopsychosocial factors in relation to chronic pain treatment selection as all participants were

new patients at a chronic pain practice and were identifying their initial treatment plan at the partner clinic; at treatment entry, almost all (96.5%) were on a primary pharmacologic treatment plan—48.8% reported opioid use and 75.6% reported non-opioid medication (prescription or OTC). Consistent with previous research, the majority of participants endorsed musculoskeletal pain (70.9%). All were seeking services at a pain clinic that provided the opportunity to engage in a multidisciplinary chronic pain treatment plan (ACPA, 2016). Consistent with prior studies investigating chronic pain populations, the sample had limited education and financial resources. Specifically, the majority of the sample (60.5%) had a high school education or less, made $40,000 or less (70.9%), and were not employed (56.5%), similar to prior chronic pain samples (Dorner et al., 2011; Hagen et al., 2002). The sample reported high average pain intensity (M = 7.58 out of 10) and pain interference (M = 7.91 out of 10), indicating the sample was experiencing significant pain and that this pain was interfering with their daily functioning.

Main Study Questions

This study had two purposes: one theoretical and one applied. The theoretical purpose was to explore the relations between the biopsychosocial factors and identify underlying latent constructs. The applied purpose was to understand how the underlying latent constructs and the various focal biopsychosocial constructs were related to chronic pain treatment selection (invasive vs. non-invasive).

Theoretical Purpose

Based on prior research, the focal biopsychosocial factors were anticipated to not only cohere into an interpretable underlying structure but to also show a number of distinct bivariate relations.

Cognition and Affect. Positive relations between specific pain attitudes (solicitude, harm, disability, and medication) and pain interference were predicted and emerged; specifically participants who reported more pain interference also reported more beliefs about experiencing more harm and disability from their pain, expecting more care and support from others, and needing medication to treat their pain. These results are consistent with previous research. For example, Turner et al. (2000) found that specific beliefs about pain, such as the belief about being disabled, were related to the level of disability in 169 chronic pain patients. Additionally, two prior studies found that pain-related beliefs were directly related to reported pain intensity and pain disability, which could be improved if these pain beliefs were altered (Edwards et al., 2006; Quartana et al., 2009).

Also as predicted, positive relations between pain catastrophizing, pain interference, passive pain coping, and depression emerged; specifically, those who reported more catastrophic thinking also reported experiencing more daily interference due to pain, engaging in passive pain coping strategies, and higher levels of depression. These findings parallel the findings summarized in a critical review of published articles conducted by Edwards et al. (2006). This review found multiple adverse outcomes related to pain catastrophizing including increased pain severity, pain sensitivity, disability, depression, and poor pain coping. Nieto et al. (2012) found that reductions in pain catastrophizing were positively associated with reduced pain interference.

It was expected that depression would display a clear constellation of relations with a variety of other focal constructs. Primary among these was coping approach and degree of pain interference. Consistent with predictions, depression was positively related to pain interference and passive pain coping, and inversely related to active pain coping and social support. These findings are consistent with epidemiological data documenting the high comorbidity between

chronic pain and depression. Specifically, the 2003 National Comorbidity Survey Replication (NCS-R) found up to 54% of pain patients have comorbid depression; the significance of this relation is illustrated by a large body of work which serves as the evidentiary base of what has been labeled the *depression-pain syndrome*—which articulates how chronic pain and depression are interconnected and can exacerbate one another, resulting in disability (Gadermann et al., 2012; Wong & Anitescu, 2017). The relation that emerged between passive coping and depression is parallel to prior results showing individuals with an external locus of control who engage in more passive behaviors report higher levels of depression (Wong & Anitescu, 2017). In general, similar to the current findings, mood has been found to be related to disability in chronic pain patients (Probst et al., 2016). More specifically, previous research has found positive relations between duration of pain, pain intensity, pain disability, and depression (Probst et al., 2016). In regards to social support, previous studies have found that dissatisfaction with support exerts a negative impact on psychological well-being, whereas satisfaction with support is associated with better pain management (Griffin et al., 2001; Holtzman et al., 2004).

It was expected that a significant inverse relation between depression and active pain coping would emerge; this hypothesis was not supported. Rather, in the current sample, the relation between active coping and depression was nonsignificant. One possible explanation for the null finding is the limited active coping used by the sample. Review of results showed a robust and significant ($p < .001$) preference for passive coping strategies ($M = 35.59$, $SD = 9.83$) compared to active coping strategies ($M = 20.60$, $SD = 5.25$). Another possible explanation is that the coping measure used (the VPMI) focuses on engaging in activities such as physical exercise, busying oneself, distraction, and doing something one enjoys but does not include

acceptance, which other studies have found to be an important facet of active coping (Jenkins et al., 2011).

Personality. Research is mixed regarding the role of personality in the chronic pain experience; however, previous research suggests neuroticism and extraversion are involved. Neuroticism was anticipated to show a positive relation with pain interference and a negative relation with active pain coping. These hypotheses were not supported; there was no relation between neuroticism and pain interference or between neuroticism and active pain coping. This was unexpected and contrary to prior findings supporting the relations between neuroticism, pain interference, and pain coping (Kadimpati et al., 2015; Ramírez-Maestre et al., 2003). It is possible that neuroticism exerts its effects less directly as one study examining the role of pain catastrophizing, pain-related fear, pain severity, and neuroticism found that neuroticism moderated the relationship between pain severity and pain catastrophizing; this led the researchers to interpret neuroticism functioning as a "vulnerability factor" (Goubert et al., 2004, p. 239). As such, the simple correlational analysis between neuroticism and pain interference used by this study may have been too limiting. However, although not predicted *a priori,* a significant positive relation between neuroticism and passive pain coping did emerge ($r = .49$, $p < .01$). As the sample reported significantly more passive pain coping strategies compared to active pain coping strategies, it appears that the *a priori* focus on active coping was misguided as few participants reported active strategies. Additionally, the current finding of a neuroticism/passive coping link is consistent with prior results, as Ramírez-Maestre et al. (2003) found higher neuroticism was related to passive coping strategies.

The role of extraversion was explored. It was expected that a significant positive relation between extraversion and active pain coping would emerge. However, no relation with active

coping emerged. Rather, a significant inverse relation between extraversion and passive pain coping (r = -.35, p < .01) was noted. The anticipated outcome was based on prior research showing higher extraversion was predictive of adaptive, active coping styles (Koh et al., 2013) and unrelated to passive coping (Ramírez-Maestre et al., 2003). The current results are likely due to the noted significant preference for passive coping in the sample, the limited use of active coping and the resultant restriction of range.

Substance Use. Substance use in relation to coping was examined. The sample reported low levels of substance use. Well over three-quarters (83%) of the sample reported no use of alcohol and problematic alcohol use was extremely low (CAGE M = .41 out of 4). These results are not unexpected given the sample's treatment profile. The partner clinic expects the clients it serves to not engage in substance use (including alcohol and illicit drugs) if prescribed an opioid. Almost half (48.8%) of the sample reported active opioid treatment at their first appointment at the partner pain clinic as a new patient and a total of 65.1% wanted opioid medication to be part of their treatment program. Based on previous research, it was expected there would be a significant positive relation between problematic substance use and passive pain coping and a significant inverse relation between problematic substance use and active pain coping. These hypotheses were not supported; substance use was not related to coping. The *a priori* hypotheses were based on a large body of research supporting the relation between substance use and passive coping. For example, an integrative review conducted by Zale et al. (2016) found that excessive alcohol consumption was related to poorer pain-related outcomes and an exacerbation in pain severity. This same review found some evidence suggesting that moderate alcohol users may experience better pain outcomes (e.g., improved quality of life, physical functioning, lower pain ratings). Although moderate alcohol use may have some short-term benefits, previous

research suggests that alcohol use is related to potentially problematic medication use (an example of passive pain coping; Michna et al., 2004). As noted, the current null findings are likely due to sample characteristics and restriction of range. Not only did the sample report a preponderance of passive coping, they also reported limited alcohol use.

Factor Structure. As expected, the focal biopsychosocial factors cohered into distinct latent constructs. Four factors related to the chronic pain experience emerged. The first factor represented psychological factors and primarily included personality characteristics including neuroticism, extraversion, openness to experience, conscientiousness, agreeableness, passive coping, depression, and specific aspects of pain attitudes regarding disability and care. Openness to experience, conscientiousness, extraversion, and agreeableness loaded negatively onto the factor and high factor scores represented a more careless, constrained and irritable presentation. The second factor represented daily functioning and included variables such as pain intensity, pain interference, tobacco use, and pain catastrophizing. All variables loaded positively onto the factor and high factor scores represented reduced functioning and high pain focus. The third factor represented control and included variables such as active coping and pain attitudes about pain being incurable, having control over one's pain, perceived harm from pain, and the influence of emotion on the pain experience. All variables loaded positively onto the factor, with the exception of two specific pain attitudes – beliefs about pain being incurable and beliefs about not causing harm. The fourth factor represented substance use and social support and included variables measuring alcohol use and marijuana in addition to social support. All of the substance variables loaded positively; in contrast, social support showed a negative loading and higher factor scores reflected reliance on substances in the absence of social support. The discovery of these four factors suggest that chronic pain does in fact have distinct, underlying facets that are

comprised of disparate surface elements and are involved in the chronic pain experience. Evidence of the biopsychosocial model can be seen in the four identified factors as they reflect latent constructs associated with personality, cognitive and social factors. The current results cannot be compared to prior findings as no prior study focused on identifying latent factors associated with the biopsychosocial model in the chronic pain population could be located. However, based on the literature examining the interconnectedness of several biopsychosocial factors, it is possible that a larger sample would have produced a different structure with narrower factors. For example, a factor primarily representing cognitive factors (e.g., pain catastrophizing and pain attitudes), another representing coping (e.g., substance use, passive and active coping, social support), and another representing psychological functioning (e.g., personality and depression).

To understand the influence of the four factors on chronic pain treatment selection, the predictive power of the four factors on current and future chronic pain adjuvant treatment selection was examined. Interestingly, no factor was predictive of current chronic pain treatment selection when examined in isolation or in combination. However, in regards to future chronic pain treatment selection, factor 3 (control) was predictive. Higher scores on control, representing the belief that chronic pain was incurable, belief that emotions increase pain, belief about not causing harm, belief about having more control over pain, and active coping, was associated with increased odds of selecting noninvasive treatment. This might be because participants who held these beliefs developed an attitude about *managing* their chronic pain versus *curing* their chronic pain. This may have contributed to participants' desire to engage in a chronic pain treatment that maintains their current level of functioning, versus focusing on trying to cure their pain condition. One explanation for the lack of predictive value of the four factors for current chronic

pain treatment selection was that current treatment choices were constrained by the timing of data collection. Current chronic pain treatment was captured by self-report and the medical record. The participants in this sample were new chronic pain patients at the practice, so at the time of completing the questionnaires, participants were actively pursuing, but had not yet initiated, treatment at the multidisciplinary chronic pain management clinic. At the first appointment, a supermajority of the sample was relying on noninvasive treatment, including nonpharmacological treatments, opioid treatment (49%), and non-opioid prescription pharmacological treatment or over-the-counter medication (76%) prior to identifying a treatment plan at the partner clinic. Additionally, at the time of their initial appointment, it is likely some of these patients were utilizing noninvasive treatments that did not require a medical provider (e.g., OTC medication).

Future chronic pain treatment selection was assessed through self-report. These preferences came from the participants' response to the question "what chronic pain treatments are you willing to try in the future?" Notably, in contrast to their current pain treatment strategy, the majority of the sample reported interest in at least one invasive treatment (63%). It is likely that the difference between current approach and future intent reflects participants' reason for seeking treatment at the partner clinic—dissatisfaction with their level of pain control. However, it appeared that participants wanted to continue or start pharmacological treatment while exploring invasive options. As noted, 97% (n = 83) of the sample reported current pharmacotherapy. Among this subgroup, 84% of those taking prescription medication (of any type) at study entry were interested in continuing to take medication in the future; only 16% of the sample taking prescription medication at study entry wanted to stop all prescription medication in the future. Overall, 81% (n = 69) of the sample wanted their treatment to include

pharmacotherapy. When the type of medication (narcotic or nonnarcotic) was examined, results indicated that 76% of the sample were taking at least one nonnarcotic prescription medication when presenting to the clinic and 49% were already taking an opiate. Among those who wanted future treatment to include pharmacotherapy, 30% were interested only in opiates, 19% wanted only a non-opiate and 51% wanted a combined medication approach. Overall, medication remained a bedrock component of intended treatment but there was high interest in augmenting it in a substantial way. Higher factor 3 (control) scores predicted this interest. Factor 3 reflected more active coping, beliefs that emotions do influence pain, beliefs that chronic pain is incurable, beliefs about having more control over pain, and beliefs about not causing harm when pain is experienced. The predictive value of this factor for future pain treatment selection is consistent with previous studies which examined the influence of specific beliefs related to pain being time-limited, pain being disabling, and medication being effective at treating pain (Jensen et al., 1999; Karoly & Ruehlman, 2006; Turner et al., 2000; Turk & Okifuji, 2002).

Applied Purpose

Prediction models were built to identify the unique predictive value of demographic variables and the focal constructs for current chronic pain treatment selection and future chronic pain treatment selection. In isolation, employment status, general pain attitudes, pain attitudes specific about control, weekly marijuana use, and pain catastrophizing all showed some (modest) relation with current treatment selection. However, none showed strong predictive power and the final model was insignificant and included only general pain attitudes; participants who reported high pain attitudes— which included beliefs that one should be taken care of by others while in pain, negative emotions increase pain, pain can be cured, one has more control over pain, one is causing harm when experiencing pain, pain makes one disabled, and medications are the best

treatment approach—were marginally more likely to select invasive procedures. This suggests that the chronic pain patients who scored higher on this variable may have been feeling desperate for relief and although they view medication as a necessary component of treatment, they have concluded it is not sufficient.

Examination of the predictive value of each focal construct in relation to future chronic pain treatment selection revealed employment status, weekly marijuana use, pain catastrophizing, active coping, and general pain attitudes showed modest relations with the outcome and were retained for inclusion in the initial model; the final model included pain catastrophizing and general pain attitudes. High catastrophizers were more likely to engage in noninvasive treatment compared to invasive treatment. On the other hand, those who reported more pain attitudes— such as attitudes that one should be taken care of by others when in pain, attitudes that negative emotions increases pain, attitudes that pain can be cured, attitudes that one has more control over pain, attitudes that one is causing harm when experiencing pain, attitudes that pain makes one disabled, and attitudes about medications being the best treatment approach— were more likely to engage in invasive treatment. These findings suggest that those who hold more catastrophic thoughts about pain may want a treatment that has the possibility to provide immediate, even if only temporary, relief and may fear that invasive approaches carry unnecessary risk. On the other hand, those who hold attitudes about needing care from others, that negative emotions increases pain, that pain can be cured, that one has more control over pain, that one is causing harm when experiencing pain, that pain makes one disabled, and that medication is one of the best treatment approaches may be more open to engaging in treatments that augment medication and have long-term, potentially curative, effects.

The current results suggest that demographic factors within a treatment-seeking sample are not tightly linked to treatment choices. This is somewhat different from what has been found in prior research. For example, past research has shown that subjective pain and perceived disability are related to employment status. For example, Dorner et al. (2011) found that unemployed individuals reported the highest pain prevalence, highest pain intensity, and stronger feelings of disability due to pain compared to those who were employed. In this study, active employment (dichotomized as employed at all/ not employed) was modestly related to a preference for invasive treatment but did demonstrate clear signal value.

Previous research supports the idea that beliefs and attitudes about pain and chronic pain treatment options influence the type of chronic pain treatment pursued. Beliefs related to medications' likely effectiveness, risks and benefits, stigma, and side effects have emerged as influential (Duensing et al., 2010; Eaves, 2015). In these studies, pain attitudes regarding opioids being an effective treatment approach for chronic pain and OTC medications being a non-harmful chronic pain treatment approach were related to current and future treatment selection. In this study, those who reported higher levels of pain attitudes including attitudes that one should be taken care of by others when in pain, attitudes that negative emotions increases pain, attitudes that pain is curable, attitudes that one has more control over pain, attitudes that one is causing harm when experiencing pain, attitudes that pain makes one disabled, and beliefs that medications are one of the best treatment approaches were more likely to engage in invasive treatment. Given that Factor 3 (control) was predictive of future treatment selection and some variables were positively loaded and others were negatively loaded, examining which specific subscales of pain attitudes nested within Factor 3 is important. The specific subscales of pain attitudes that contributed to Factor 3 (control) included the belief that chronic pain was incurable,

feeling in control of the pain, believing that emotions do influence the pain experience, and believing that harm is not being done. Participants who reported higher scores on Factor 3 were less likely to engage in invasive treatment, indicating participants desire to engage in a chronic pain treatment that managed their current level of functioning, not necessarily cure their chronic pain condition.

As noted, virtually all the sample (97%) was already taking some form of pain medication (including opioid, non-opioid, and OTC medication) at their first appointment. Of these participants, 18% wanted to stop taking medications entirely. Over half (81%) of participants who were currently prescribed opioids were still interested in taking opioids in the future and only 19% were interested in stopping opioid treatment in the future. Further, 51% of participants who were not currently prescribed opioids were interested in starting opioid treatment in the future. Although the reason for referral to the pain clinic was not assessed, it is possible that some participants were referred to the partner clinic solely for medication management because their primary prescriber no longer felt comfortable prescribing pain medications. Vijayaraghavan et al. (2012) examined the confidence in and satisfaction with available chronic pain management protocols in a sample of 61 primary care physicians. They found that a supermajority of the primary care physicians (74%) felt comfortable prescribing opioid analgesics to patients with chronic pain conditions who did not have a substance use history. However, they also found that over half (54%) of the primary care physicians reported low confidence and nearly half (84%) reported low satisfaction with their options and ability to treat chronic pain. This suggests that primary care physicians may be more likely to refer patients to a specialized chronic pain practice for medication management.

Limitations and Future Directions

A major limitation of this study is the modest sample size. Given that this study examined a multitude of biopsychosocial factors and their relations to chronic pain treatment selection, a large sample size is necessary to make meaningful interpretations. The final sample size was less than half of the intended sample size and only 18% of those recruited opted to participate. Although it is impossible to know why 82% of possible participants declined to participate, a likely reason was concern that the information they provided would not be kept confidential, despite assurances to the contrary, and shared with their provider. To encourage more participation in future studies, it may be necessary to focus only on self-report and not use the medical record as this would allow anonymous data collection, thereby guaranteeing privacy to participants. This study provided multiple documents to ensure patient confidentiality (e.g., informed consent, letter from lead medical doctor, letter from lead researcher), but participants were expected to turn in their completed packet at their first appointment. This could have suppressed participation in the study. Similarly, the study included measures of substance use and abuse. Given that the partner clinic requires all patients who are prescribed an opioid to complete measures of alcohol use, tobacco use, and illicit drug use and sign a contract agreeing to abstain from legal and illicit substances, it may be that potential participants with more active substance use self-selected out rather than misrepresent their use on the measures. Support for this as a possibility is seen in the low level of substance use reported by the sample. Another possible contributor to the modest sample size is the COVID-19 pandemic impacting new chronic pain patient appointments. To ensure the safety of patients and staff, in-person face-to-face appointments were cancelled until telemedicine technology was established. Then, new patients were only offered telemedicine appointments, which required the lead researcher to

change the data collection process. Eligible participants were mailed packets and were instructed to mail anonymous completed packets to the lead researcher with pre-paid postage. This new approach to data collection may have been inconvenient to participants. Another possible contributor to the modest sample size was changes in providers at the partner clinic who were accepting new patients. During data collection, the partner clinic reduced the number of providers who were available to see new patients, reducing the number of possible participants. Future studies should strive for a larger sample, more in keeping with the initial target of 250, to better identify underlying latent constructs.

In addition to the sample size, another limitation is the racial composition of the sample. The majority of this sample was white and lived biopsychosocial experience may be different for people of color. A more racially and ethnically diverse sample is required to understand more fully how chronic pain is experienced and managed. Review of the literature reveals that the chronic pain experience within nondominant cultures is understudied and studying a diverse sample that represents the ethnic and racial composition of the US would make model building both more generalizable and applicable. Similarly, recruiting participants who are not required to abstain from substance use and instead represent the full range of substance use may result in different findings and more generalizable results.

Further, although the partner clinic offered both invasive and non-invasive chronic pain treatment options, a number of first-line non-invasive treatments were not offered, including acupuncture, PT, chiropractics, and psychotherapy. The partner clinic referred participants to other providers in the community if they wished to access these noninvasive approaches. It is possible that participants would be more inclined to engage in noninvasive approaches if they were provided in-house, especially treatments like CBT for chronic pain, yoga, and tai chi.

Despite these limitations, the results from this study suggest that biopsychosocial factors are involved in the chronic pain experience. However, these broad factors do not necessarily influence or predict treatment selection. It appears that narrower cognitive structures, specifically beliefs and attitudes regarding the general pain experience and pain catastrophizing, are most influential in the context of treatment selection. Future research should focus on examining cognitive factors on treatment selection to better understand the predictive value of these factors on chronic pain treatment selection.

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Tables

Table 1

Participant Demographics

Characteristics	*n*	%
Ethnicity *n*		
Black	1	1.2
White	80	93.0
Prefer not to say	5	5.8
Education *n*		
Some HS or less	14	16.3
High school	38	44.2
Some College/Associates	7	8.1
College	3	3.5
Post-Graduate	3	3.5
Prefer not to say	21	24.4
Employment Status *n*		
Full Time	18	20.9
Part Time	28	32.6
Retired	3	3.5
Disabled	15	17.4
Unemployed	22	25.6
Prefer not to say	0	
Income *n*		
<21k	42	48.8
21k-40k	19	22.1
41k-60k	8	9.3
61k-80k	0	
>80k	1	1.2
Prefer not to say	16	18.6

Note. $N = 86$.

Table 2

Chronic Pain History for Participants

Condition	*n*	%	*Mean*	*SD*
Condition				
Musculoskeletal	61	70.9		
Postsurgical or Posttraumatic	6	7.0		
Neuropathic	2	2.3		
Chronic Primary Pain	7	8.1		
Chronic Visceral Pain	2	2.3		
Combination	8	9.3		
Current chronic pain treatment at first appointment				
Noninvasive	60	69.8		
Invasive	26	30.2		
Self-reported future chronic pain treatment preference				
Noninvasive	30	34.9		
Invasive	54	62.8		
Did not report	2	2.3		
Currently prescribed any medication at first appointment				
Yes	83	96.5		
No	3	3.5		
Currently prescribed opioid medication at first appointment				
Yes	42	48.8		
No	44	51.2		
Self-reported future noninvasive chronic pain treatment preference (not offered at clinic)				
PT	5	5.8		
Chiropractics	3	3.5		
Acupuncture	2	2.3		
Psychological Therapy	4	4.7		
Yoga/Tai Chi	2	2.3		
Biofeedback	1	1.2		
Relaxation	1	1.2		
Combination	33	38.4		
No interest	35	40.7		
Referral or discussion regarding noninvasive chronic pain treatment options not offered at clinic				
Yes	32	22.1		
No	19	37.2		
Average Pain Intensity			7.58	1.74
Average Pain Interference			7.91	1.99

Note. $N = 86$.

Table 3

Means and Standard Deviations of Study Variables

Measure	*M*	*SD*
CAGE	.41	.96
BFI – Neuroticism	26.12	7.59
BFI – Openness	31.78	7.69
BFI – Agreeableness	35.24	5.82
BFI – Conscientiousness	32.58	6.40
BFI – Extraversion	22.76	6.48
CES-D	24.30	12.39
PCS	27.92	13.07
VPMI – Passive	35.59	9.83
VPMI – Active	20.60	5.25
SOPA – Solicitude	1.45	1.33
SOPA – Emotionality	2.31	1.38
SOPA – Cure	2.10	.93
SOPA – Control	1.59	.80
SOPA – Harm	2.50	1.00
SOPA – Disability	2.92	.79
SOPA – Medication	2.90	1.07
MSPSS	61.06	13.67

Note. $N = 86$. CAGE; BFI - Big Five Inventory; CES-D - Center for Epidemiologic Studies Depression Scale; PCS - Pain Catastrophizing Scale; VPMI - Vanderbilt Pain Management Inventory; SOPA - Survey of Pain Attitudes – Brief; MSPSS - Multidimensional Scale of Perceived Social Support.

Table 4

Correlation Matrix of Study Variables (*N* = 86)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.Pin	-	.65[b]	.15	-.04	-.09	-.06	.18	-.01	.08	-.12	.39[b]	.12	.17	.15	.44[b]	.24[a]	-.33[b]	-.03	.13	-.08	.08	-.10	.02
2.PInf		-	.15	-.15	-.15	-.10	.29[a]	.09	.08	-.24[a]	.43[b]	.24[a]	.33[b]	.31[b]	.47[b]	.40[b]	-.37[b]	-.09	.20	-.19	.14	-.14	-.01
3. Tob. Use			-	.12	-.00	.15	.09	.07	-.06	-.14	.20	.16	.15	.06	.30[b]	.23[b]	-.21	-.01	.27[a]	-.03	.04	-.10	-.07
4. CAGE				-	.44[b]	.01	.15	.32[b]	-.19	.20	-.34[b]	.01	-.41[b]	.23[a]	-.02	-.04	.18	-.19	.18	.07	-.48[b]	-.25[a]	-.14
5. Alc. Use					-	.26[a]	-.02	.16	.04	.03	-.33[b]	-.12	-.19	.13	-.07	-.12	.11	-.22[a]	.12	-.02	-.30[b]	.00	.00
6.Marij. Use						-	-.08	-.10	-.07	-.06	-.08	-.04	-.11	-.13	-.12	-.19	-.04	-.05	-.01	.15	.16	.01	.07
7. SOPA-S							-	.54[b]	.04	.35[b]	.08	.36[b]	.12	.52[b]	.44[b]	.48[b]	-.01	-.01	.40[b]	-.43[b]	-.26[b]	-.43[b]	-.23[a]
8.SOPA-E								-	-.27[b]	.45[b]	-.16	.34[b]	.01	.64[b]	.37[b]	.44[b]	.20	-.22[a]	.56[b]	-.25[a]	-.35[b]	-.40[b]	-.27[a]
9.SOPA-Cu									-	-.23[a]	.40[b]	-.06	.12	-.07	-.12	-.08	-.21	.07	-.17	-.13	.05	.16	.12
10. SOPA-Co										-	-.28[b]	.29[b]	-.13	.23[a]	.02	.22[a]	.44[b]	-.09	.14	-.22[a]	-.27[a]	-.29[b]	-.17
11. SOPA-H											-	.36[b]	.49[b]	.08	.31[b]	.39[b]	-.51[b]	.08	.04	-.24[a]	.14	.02	-.18
12. SOPA-D												-	.16	.39[b]	.40[b]	.53[b]	-.13	-.14	.29[b]	-.36[b]	-.12	-.28[a]	-.26[a]
13. SOPA-M													-	.02	.25[a]	.27[a]	-.26[a]	.22[a]	.07	-.22[a]	.19	-.02	-.08
14. CES-D														-	.61[b]	.57[b]	-.05	-.31[b]	.66[b]	-.53[b]	-.35[b]	-.46[b]	-.48[b]
15. PCS															-	.75[b]	-.13	-.08	.55[b]	-.43[b]	-.15	-.25[a]	-.26[a]
16. VPMI-P																-	.01	-.18	.49[b]	-.52[b]	-.18	-.34[b]	-.35[b]
17. VPMI-A																	-	.08	-.06	.15	-.02	.21	.11
18. MSPSS																		-	-.20	.18	.27[a]	.15	.18
19. BFI-N																			-	-.48[b]	-.41[b]	-.54[b]	-.38[b]
20. BFI-O																				-	.41[b]	.52[b]	.60[b]
21. BFI-A																					-	.50[b]	.42[b]
22. BFI-C																						-	.50[b]
23. BFI-E																							-

Note. *N* = 86. PIn – Pain Intensity; PInf – Pain Interference; Tob Use – Tobacco Use; CAGE; Alc Use – Alcohol Use; Marij. Use – Marijuana Use; SOPA – Survey of Pain Attitudes – Brief (Solicitude, Emotionality, Cure, Control, Harm, Disability, Medication subscales); CESD – Center of Epidemiologic Studies Depression Scale; PCS – Pain Catastrophizing Scale; VPMI – Vanderbilt Pain Management Inventory (Passive and Active subscales); BFI– Big Five Inventory (Neuroticism, Openness, Agreeableness, Conscientiousness, and Extraversion subscales).

[a] = $p < .05$. [b] = $p < .01$, two-tailed.

Table 5

Exploratory Factor Analysis of 23 Variables

Items	Factors			
	Psychological	Functioning	Control	Substance Use/Support
Pain Intensity	.004	**.706**	-.163	.047
Pain Interference	.098	**.763**	-.174	.165
Marijuana Use	-.196	.074	-.134	**-.381**
Tobacco Use	.017	**.511**	-.055	-.170
CAGE	.191	-.021	.286	**-.694**
Alcohol Use	.056	-.046	.024	**-.705**
BFI-N	**.644**	.358	.168	-.202
BFI-O	**-.827**	-.018	.192	-.162
BFI-A	**-.661**	.216	-.012	.410
BFI-C	**-.727**	-.055	-.001	.164
BFI-E	**- .750**	.105	.156	.015
CES-D	**.724**	.345	.212	-.115
PCS	.454	**.686**	.160	.145
VPMI-Passive	**.595**	.491	.208	.295
VPMI-Active	-.113	-.358	**.711**	.024
MSPSS	-.282	-.097	.029	**.438**
SOPA Solicitude	**.563**	.289	.281	.113
SOPA Emotions	.549	.209	**.572**	-.136
SOPA Cure	.008	-.073	**-.594**	.113
SOPA Control	.388	-.268	**.612**	.090
SOPA Harm	.174	.419	**-.560**	.465
SOPA Disability	**.485**	.298	.127	.246
SOPA Meds	.110	.292	-.246	**.547**

Table 6

Univariate Logistic Regression Tests of the Four Factors and Current Treatment

Independent Variable	β	Wald χ^2	p	Exp(β)	*CI*
Factor 1	-.01	.76	.38	1.01	.99 – 1.02
Factor 2	-.02	1.16	.28	.98	.95 – 1.01
Factor 3	.01	.11	.74	1.01	.98 – 1.04
Factor 4	-.00	1.11	.29	.99	.99 – 1.00

Note. N = 86. Factor 1 – Psychological Factors; Factor 2 – Daily Functioning; Factor 3 – Control; Factor 4 – Substance Use/Support.

Table 7

Univariate Logistic Regression Tests of the Four Factors and Future Treatment

Variable	β	*SE*	Wald χ^2	*df*	*p*	Exp(β)	*CI*
Factor 1	1.00	.01	.03	1	.87	1.00	.99 – 1.01
Factor 2	-.02	.02	1.16	1	.28	.98	.95 – 1.01
Factor 3	-.04	.02	5.04	1	.03	.97	.94 - .99
Factor 4	-.00	.00	.67	1	.41	.99	.99 – 1.00

Note. $N = 84$. Factor 1 – Psychological Factors; Factor 2 – Daily Functioning; Factor 3 – Control; Factor 4 – Substance Use/Support.

Table 8

Logistic Regression of SOPA – Total and Current Treatment Selection

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)	*CI*
SOPA – Total	.80	.45	3.14	.07	2.22	.92 – 5.38
Constant	-2.60	1.04	6.25	.01	.07	
Model χ^2 =	3.29	p = .07				
Pseudo R^2 =	.04					

Note. N = 86. SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Table 9

Logistic Regression of PCS Total, SOPA Total and Future Treatment Selection

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)	*CI*
PCS Total	-.04	.02	3.91	.05	.96	.92 – 1.00
SOPA Total	1.01	.51	3.89	.05	2.75	1.01 – 7.51
Constant	-.41	1.02	.16	.69	.67	
Model χ^2 =	5.84	(p = .05)				
Pseudo R^2 =	.07					

Note. N = 84. PCS – Pain Catastrophizing Scale; SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix A

IRB Approval from Xavier University

January 29, 2019

Kristen Kemp

Dear Ms. Kemp:

The IRB has completed the review of your protocol *#18-055, An Exploratory Study of Biopsychosocial Factors Related to Chronic Pain Treatment Selection* using expedited review procedures. We appreciate your thorough treatment of the issues raised and your timely response. Your study is approved in the Expedited category under Federal Regulation 45CFR46.

Approval expires January 29, 2020. A progress report, available at http://www.xavier.edu/irb/forms.cfm, is due by that date. If the IRB has not received a progress report from you before MIDNIGHT on the study's expiration date, we will AUTOMATICALLY set your study's status to "Closed". **No further data collection is allowed at that point, and if you wish to re-commence data collection, you will be required to submit a new application, along with all relevant materials, to our office.**

Although we will endeavor to send you a reminder, it is **your responsibility** as the researcher to ensure that your progress report and any request for an extension of data collection is submitted to our office before your approval expires.

If you wish to modify your study, including any changes to the approved Informed Consent form, it will be necessary to obtain IRB approval prior to implementing the modification. If any adverse events occur, please notify the IRB immediately.

If you have any questions, please contact the IRB office at 745-2870. We wish you success with your research!

Sincerely,

[redacted]

Morrie Mullins, Ph.D.
Chair, Institutional Review Board
Xavier University

Appendix B

Informed Consent

Chronic Pain Treatment Selection

My name is Kristen Kemp and I am a student at Xavier University. You are being given the opportunity to volunteer to participate in my doctoral dissertation project conducted through the School of Psychology at Xavier University.

If you decide to participate in the project, please return the attached questionnaires in the postage-paid envelope provided; returning the questionnaires indicates that you have read this form and are giving your informed consent to participate. This form is for you to keep. If you have any questions at any time during the study or would like to discuss it in more detail before you decide whether to participate, you may contact Kristen Kemp at kempk4@xavier.edu or her dissertation chair, Dr. Susan Kenford, at kenford@xavier.edu. Any questions about your rights as a research subject should be directed to Xavier University's Institutional Review Board at (513) 745-2870.

Purpose of Study: To understand factors associated with chronic pain treatment selection.
Why are you selected: All new patients at Premiere Pain Treatment Institute who will be receiving chronic pain treatment are being invited to participate in this study.
What is required: If you agree to participate in the study, you will complete the following attached questionnaires. Your participation will take approximately 20 minutes.
Risks: There are no known risks for your participation.
Benefits: There are no direct benefits to you. However, the results from this study could help guide more effective treatment for chronic pain patients.
Confidentiality: Your responses will be kept confidential. None of your responses will be entered into your medical chart, communicated to your treatment providers, or used to determine eligibility for any form of chronic pain treatment. All questionnaires are precoded and you will not place your name on any measure. All completed forms will be kept in a secure and locked cabinet at Xavier University and will be destroyed at the completion of the study. All results will be reported on a group level; your individual responses will not be reported or shared.

This study is voluntary. You can refuse to participate in the study. Refusal to participate in this study will have no effect on current and future treatment at the Premiere Pain Treatment Institute. You are free to withdraw from the study at any time without penalty.

I have been given information about this research study and its risks and benefits and have had the opportunity to ask questions and to have my questions answered to my satisfaction. I freely give my consent to participate in this research project by completing the questionnaires.

Appendix C

Univariate Regression Analyses Between Focal Constructs and Current Treatment Selection

Variable	β	Wald χ^2	p	Exp(β)	*CI*
Sex	-.13	.08	.78	.88	.34 – 2.25
Ethnicity	-20.47	.00	.99	.00	.00 - .00
Education	.20	.51	.48	1.22	.71 – 2.08
Employment	1.19	3.10	.08	3.29	.87 – 12.35
Income	.09	.08	.78	1.10	.58 – 2.06
Average Pain Intensity	-.02	.02	.90	.98	.75 – 1.28
Pain Interference	-.08	.43	.51	.93	.74 – 1.16
CAGE	.41	2.97	.09	1.50	.95 – 2.38
Weekly Alcohol Use	.00	.30	.59	1.00	.99 – 1.01
Weekly Marijuana Use	.01	1.31	.25	1.01	.99 – 1.01
BFI – N	.01	.10	.76	1.01	.95 – 1.07
BFI – E	-.03	.56	.45	.97	.90 – 1.05
CES-D	.01	.42	.52	1.01	.98 – 1.05
PCS	-.02	1.40	.24	.98	.94 – 1.01
VPMI – Passive	-.02	.53	.47	.98	.94 – 1.03
VPMI – Active	.01	.08	.78	1.01	.93 – 1.11
MSPSS	-.01	.09	.76	1.00	.96 – 1.03
SOPA – Total	.80	3.14	.08	2.22	.92 – 5.38

Note. $N = 86$. BFI – Big Five Inventory (Neuroticism, Openness, Agreeableness, Conscientiousness, Extraversion); CES-D – Center for Epidemiologic Studies Depression Scale; PCS – Pain Catastrophizing Scale; VPMI – Vanderbilt Pain Management Inventory; SOPA - Survey of Pain Attitudes – Brief; MSPSS - Multidimensional Scale of Perceived Social Support.

Appendix D

Univariate Regression Analyses Between Focal Constructs and Future Treatment Selection

Variable	β	Wald χ^2	p	Exp(β)	*CI*
Sex	.11	.05	.82	1.11	.45 – 2.76
Ethnicity	-.64	.56	.46	.53	.10 – 2.80
Education	-.14	.27	.60	.87	.52 – 1.47
Employment	.92	.53	.08	2.50	.88 – 7.10
Income	-.17	.29	.59	.85	.46 – 1.57
Average Pain Intensity	-.02	.02	.89	.98	.76 – 1.27
Pain Interference	.03	.08	.78	1.03	.83 – 1.29
CAGE	-.05	.04	.84	.95	.61 – 1.51
Weekly Alcohol Use	.00	.00	.97	1.00	.99 – 1.01
Weekly Marijuana Use	.32	.00	.99	1.38	.00 – 3.39
BFI – N	-.02	.53	.47	.98	.92 – 1.04
BFI – E	.01	.04	.84	1.01	.94 – 1.08
CES-D	.01	.24	.63	1.01	.97 – 1.05
PCS	-.02	1.57	.21	.98	.94 – 1.01
VPMI – Passive	-.00	.01	.94	.99	.95 – 1.05
VPMI – Active	-.06	1.94	.16	.94	.86 – 1.03
MSPSS	.00	.01	.94	1.00	.97 – 1.04
SOPA – Control	-.31	1.14	.29	.73	.41 – 1.30
SOPA – Disability	.21	.50	.48	1.23	.69 – 2.19
SOPA – Total	.58	1.64	.20	1.78	.74 – 4.30

Note. $N = 86$. BFI – Big Five Inventory (Neuroticism, Openness, Agreeableness, Conscientiousness, Extraversion); CES-D – Center for Epidemiologic Studies Depression Scale; PCS – Pain Catastrophizing Scale; VPMI – Vanderbilt Pain Management Inventory; SOPA - Survey of Pain Attitudes – Brief; MSPSS - Multidimensional Scale of Perceived Social Support.

Appendix E

Logistic Regression of Current Treatment Selection – Model 1

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)	*CI*
Employment Status	.99	.75	1.76	.19	2.70	.62 – 11.67
CAGE	.42	.26	2.77	.09	1.53	.93 – 2.52
Weekly Marijuana Use	.01	.00	1.42	.23	1.01	.99 – 1.01
PCS	-.07	.03	5.54	.02	.94	.89 - .99
SOPA – Control	-.18	.39	.20	.66	.84	.39 – 1.81
SOPA – Total	1.76	.71	6.11	.01	5.80	1.44 –23.40
Constant	-4.72	1.61	8.61	.00	.01	
Model χ^2 =	16.92	(p=.01)				
Pseudo R^2 =	.18					

Note. N = 86. PCS – Pain Catastrophizing Scale; SOPA Control - Survey of Pain Attitudes – Brief (Control subscale and Total score)

Appendix F

Logistic Regression of Current Treatment Selection – Model 2

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
Employment Status	.93	.73	1.64	.20	2.54
CAGE	.40	.25	2.61	.11	1.49
Weekly Marijuana Use	.01	.00	1.47	.23	1.01
PCS	-.06	.03	5.47	.02	.94
SOPA – Total	1.63	.65	6.30	.01	5.12
Constant	-4.71	1.62	8.45	.00	.01
Model χ^2 =	16.72	(p = .01)			
Pseudo R^2 =	.18				

Note. N = 86. PCS - Pain Catastrophizing Scale; SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix G

Logistic Regression of Current Treatment Selection – Model 3

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
Employment Status	1.05	.72	2.13	.14	2.87
CAGE	.39	.24	2.50	.11	1.47
PCS	-.06	.03	5.69	.02	4.39
SOPA – Total	1.48	.62	5.71	.02	.94
Constant	-4.50	1.58	8.09	.00	.01
Model χ^2 =	15.15	($p < .01$)			
Pseudo R^2 =	.16				

Note. N = 86. PCS – Pain Catastrophizing Scale; SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix H

Logistic Regression of Current Treatment Selection – Model 4

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
CAGE	.43	.24	3.25	.07	1.54
PCS	-.06	.03	5.40	.02	5.12
SOPA – Total	1.63	.62	7.04	.01	.94
Constant	-3.06	1.15	7.12	.01	.05
Model χ^2 =	12.74	(p = .01)			
Pseudo R^2 =	.14				

Note. N = 86. PCS – Pain Catastrophizing Scale; SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix I

Logistic Regression of Current Treatment Selection – Model 5

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
CAGE	.42	.24	3.08	.08	1.52
SOPA – Total	.84	.46	3.30	.07	2.32
Constant	-2.89	1.09	7.06	.01	.06
Model χ^2 =	6.50	(p = .04)			
Pseudo R^2 =	.07				

Note. N = 86. SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix J

Logistic Regression of Future Treatment Selection – Model 1

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
Employment Status	.98	.59	2.68	.10	2.66
Weekly Marijuana Use	.34	112.44	.00	.99	1.40
PCS Total	-.05	.02	4.45	.03	.95
VPMI – Active	.07	.05	2.19	.14	.93
SOPA – Total	1.05	.54	3.79	.05	2.87
Constant	-.67	1.71	.15	.69	.51
Model χ^2 =	15.77	(p = .01)			
Pseudo R^2 =	.17				

Note. N = 84. PCS – Pain Catastrophizing Scale (Total score); VPMI Active – Vanderbilt Pain Management Inventory (Active subscale); SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix K

Logistic Regression of Future Treatment Selection – Model 2

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
Employment Status	.99	.58	2.87	.09	2.69
PCS Total	-.05	.02	5.23	.02	.95
VPMI – Active	-.07	.05	2.34	.12	.93
SOPA – Total	.96	.53	3.17	.08	2.61
Constant	-.19	1.68	.01	.91	.83
Model χ^2 =	11.37	(p = .02)			
Pseudo R^2 =	.12				

Note. N = 84. PCS – Pain Catastrophizing Scale (Total score); VPMI Active – Vanderbilt Pain Management Inventory (Active subscale); SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Appendix L

Logistic Regression of Future Treatment Selection – Model 3

Variable	β	*SE*	Wald χ^2	*p*	Exp(β)
Employment Status	.99	.57	3.00	.08	2.69
PCS Total	-.05	.02	4.61	.03	.95
SOPA – Total	.91	.52	3.09	.08	2.49
Constant	-1.78	1.29	1.90	.17	.17
Model χ^2 =	8.89	(p = .03)			
Pseudo R^2 =	.10				

Note. N = 84. PCS – Pain Catastrophizing Scale (Total score); SOPA Total - Survey of Pain Attitudes – Brief (Total score).

Summary

Title: An Exploratory Study of Biopsychosocial Factors Related to Chronic Pain Treatment Selection

Problem: Chronic pain impacts anywhere between 2% and 40% of the general population (Glajchen, 2001). Chronic pain sufferers have a wide range of treatment options; although treatment options vary in approach and focus, a shared feature is they target symptoms and not underlying mechanisms or causes of chronic pain. One strategy to expand pain treatment option utilization is to view the experience of pain within a larger or holistic frame such as the biopsychosocial model (Gatchel et al., 2007). When viewed through the lens of the biopsychosocial model, multiple biological (e.g., age, sex, personality traits), psychological (e.g., personality traits, cognitive, affective), and social factors (e.g., socioeconomic status, coping, social support) emerge that influence the experience, development, and maintenance of chronic pain (Gatchel et al., 2007). Such factors are implicated in the decision-making processes chronic pain patients use to select a chronic pain management treatment (Jensen et al., 2011; Schieffer et al., 2005; Smith et al., 2015; Turk & Okifuji, 2002). This study had two purposes: one theoretical and one applied. The theoretical purpose was to understand the overall relations between the focal constructs (pain intensity, pain interference, depression, pain attitudes, pain catastrophizing, personality, social support, coping, and substance use), to identify any underlying or core constituent factors and to determine how these latent factors are related to treatment choice (noninvasive vs. invasive). The applied purpose was to use model building techniques to investigate how each focal construct is related to treatment choice and identify which carry unique predictive information regarding treatment choice.

Method: Participants in this study were 86 new chronic pain patients at a Midwestern chronic pain clinic (*partner clinic*). The sample was largely White (93%), had a high school or less education (51%), made < $21,000 a year (49%) and were middle aged *Mage* = 58; about half (54%) held part or fulltime employment. The most common type of chronic pain condition was musculoskeletal (71%).

Participants completed an array of measures: a background questionnaire (demographic information, chronic pain condition, past, current, and future chronic pain treatment); the pain intensity (NPRS); pain interference (PEG); substance use patterns (alcohol use, marijuana use, tobacco use) and CAGE; Big Five Inventory (BFI); Center for Epidemiologic Studies Depression Scale (CES-D); Survey of Pain Attitudes – Brief (SOPA-B); Pain Catastrophizing Scale (PCS); Vanderbilt Pain Management Inventory (VPMI); and Multidimensional Scale of Perceived Social Support (MSPSS). Participants completed the questionnaires prior to their initial appointment at the partner clinic.

Findings: Correlation analyses assessed the relations between cognition, affection, personality, and substance use. Specific pain attitudes (Solicitude ($r = .29$, $p < .05$), Harm ($r = .43$, $p < .01$), Disability ($r = .24$, $p < .05$), and Medication ($r = .33$, $p < .01$)) showed significant positive relations to pain interference. Pain catastrophizing (PCS) was significantly positively related to pain interference (PEG; $r = .47$, $p < .01$), passive pain coping (VPMI; $r = .75$, $p < .01$), and depression (CES-D; $r = .61$, $p < .01$). Depression (CES-D) was significantly positively related to

pain interference (PEG; $r = .31$; $p < .01$), passive pain coping (VPMI; $r = .57$, $p < .01$), and significantly inversely related to social support (MSPSS; $r = -.31$, $p < .01$). No relations between neuroticism or extraversion with pain interference and coping were seen. No relations between the problem drinking and passive coping or active coping emerged. Average drinks and marijuana use were not related to pain catastrophizing, but tobacco use was positively related to pain catastrophizing (PCS; $r = .30$, $p < .01$).

An exploratory factor analysis (EFA) using principal component analysis and Varimax rotation was conducted on the *a priori* focal constructs to identify underlying latent factors. The EFA explained 56% of the variance and revealed four factors: 1) psychological factors (25% of variance); 2) daily functioning (16% of variance); 3) control (8% of variance); 4) substance use/support (7% of variance). Predictor variables comprised of the items associated with each of the four factors (psychological factors, daily functioning, control, and substance use/support) were created. Logistic regression was used to examine their zero-order relation to current and future chronic pain treatment selection. No factor was predictive of current chronic pain treatment selection; however, factor 3 (control) was predictive of future chronic pain treatment selection; higher scores reflected more active coping, beliefs that emotions do influence pain, beliefs that chronic pain is incurable, beliefs about having more control over pain, and beliefs about not causing harm when pain is experienced and associated with a lower likelihood to use invasive treatment. Formal modeling was used to create prediction models of current and future treatment selection (0 =noninvasive; 1=invasive) and to identify the unique predictive value of demographic variables and focal constructs. No significant relations with current treatment selection emerged. In regards to future treatment selection, employment status, weekly marijuana use, PCS total, VPMI – Active Coping, and SOPA – Total were retained for inclusion. The final model included PCS total ($\beta = -.04$, Exp(β) = .96) and SOPA – Total ($\beta = 1.01$, Exp(β) = 2.75).

Implications: The current study sought to explore the relations between focal biopsychosocial factors, identify underlying latent constructs, and examine the predictive value of the focal and latent constructs on current and future chronic pain treatment selection (noninvasive vs. invasive). This study highlighted the relation between several biopsychosocial factors and revealed four underlying constructs: psychological factors, daily functioning, control, and substance use/support. None of the underlying factors were predictive of current chronic pain treatment selection and only control was predictive of future chronic pain treatment. Similarly, no focal construct was predictive of current treatment approach. However, future treatment selections were associated with general pain attitudes about chronic pain and pain catastrophizing; high catastrophizers were more likely to engage in noninvasive treatment compared to invasive treatment— whereas those who reported more pain attitudes, such as attitudes that one should be taken care of by others when in pain, attitudes that negative emotions increases pain, attitudes that pain can be cured, attitudes that one has more control over pain, attitudes that one is causing harm when experiencing pain, attitudes that pain makes one disabled, and attitudes about medications being the best treatment approach—were more likely to pursue invasive treatment. The current findings suggest that cognitive factors play a major role in the decision making process of a chronic pain patient who is deciding on invasive vs. noninvasive treatment approaches to manage the chronic pain condition(s).