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Impact of Physical Therapist Attitudes and Beliefs on the Outcomes of Patients with Low Back Pain

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The Impact of Physical Therapist Attitudes and Beliefs on the Outcomes of Patients with Low Back Pain.

by

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Abstract

Introduction: Physical therapist attitudes and beliefs about low back pain (LBP) have been shown to influence patient beliefs and affect clinician behavior. The purpose of this project was to investigate physical therapist attitudes and beliefs about LBP, identify factors that influence those beliefs, and determine if attitudes and beliefs have an impact on patient outcomes.

Methods: This study was a retrospective cohort design that included a survey of physical therapists and the collection of patient outcomes from Focus on Therapeutic Outcomes, Inc. (FOTO). Attitudes and beliefs were measured using the Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS) and the Pain Attitudes and Beliefs Scale for Physiotherapists (PABS-PT). Outcomes were measured using Computerized Lumbar Functional Scale change scores (CLFS), CLFS residual scores, number of visits, and Fear Avoidance Beliefs Scale physical activity subscale (FABQpa).

Results: Complete attitudes and beliefs scales were collected from 140 physical therapists. PABS-BM and PABS-BPS scores were predicted by a model that included age between 18 and 34, board certification, and NPQ scores. A multiple variate model could not be developed for HC-PAIRS scores, as NPQ score was the only significant predictor. A linear model containing HC-PAIRS scores and change in FABQpa scores predicted 16.1% of the variability in CLFS scores and 12.8% of the variability in the number of visits. HC-PAIRS was a univariate logistic predictor for a greater than expected CLFS change for the 10 patient cut-off sample. Receiver operating characteristic (ROC) curve identified an HC-PAIRS cut-off score of 30.50. This score had a sensitivity of .564 and specificity of .641. Scores on the PABS-PT scale were not multivariate predictors of any outcome measure.

Conclusion: Several factors predicted LBP-related attitudes and beliefs, with the most consistent predictor being knowledge of current pain science. The LBP attitudes and beliefs of physical therapists were not consistent predictors of outcomes. HC-PAIRS scores were found to be related to outcomes in 8 of the 33 performed analyses; however, this relationship was not in the predicted direction. Physical therapists who believed there was a stronger relationship between pain and disability had better outcomes.

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Chapter 1: Introduction

Introduction

This chapter is an introduction to the dissertation. It will discuss the problem that was addressed, describe the significance of the dissertation, outline the research questions and hypotheses, and define important terms that are used in the dissertation. The chapter also gives a brief overview of the current literature that demonstrates the significance of the problem addressed in this paper.

Problem Statement

Low back pain (LBP) is a complex disorder that places a major burden on individuals and society.[1,2] Bio-pathoanatomical (BPA) models of LBP can explain some aspects of the disorder; however, they have struggled to produce highly effective treatment strategies.[3-6] In hopes of improving on BPA models, more comprehensive explanations, which include BPA, psychological and social factors, have been proposed.[7] These models consider the impact that cognitive factors have on the perception of pain and on the severity of disability. Models such as the biopsychosocial model (BPS), cognitive behavioral theory (CBT), and the fear-avoidance beliefs (FAB) model, stress that subjective factors, such as patient beliefs, have an influence on musculoskeletal conditions. Interventions aimed at influencing these subjective factors seem to have a positive influence on recovery.[8] It has recently been proposed that similar cognitive factors in healthcare providers may have an influence on patients with musculoskeletal pain.[9] For example, physical therapist attitudes and beliefs about LBP may influence the beliefs of their patients and may affect the advice and treatment physical therapists provide to patients.[10,11]

It is currently unclear, however, if physical therapist attitudes and beliefs about LBP have an influence on patient beliefs and/or if they have an impact on patient outcomes. If physical therapist LBP-related attitudes and beliefs do influence outcomes, it suggests that strategies to optimize physical therapist attitudes and beliefs should be developed.

LBP has an estimated global prevalence of 31% and is the number one cause of disability around the globe.[1,2] The reported lifetime prevalence of LBP is variable and has been reported to be approximately 80%.[12-14] In 2010, LBP accounted for 83 million disability-adjusted life years, making it the sixth greatest contributor to years lived with disability globally.[2] Chronic low back pain (CLBP) is less prevalent but results in a significant burden on individuals and society. Studies examining the prevalence of CLBP throughout the world have reported ranges from 3.9%-20%.[15] A 2010 internet-based study of 27,035 individuals from the United States (US) reported an 8.1% prevalence of LBP lasting greater than 6 months.[16] LBP costs the US more than $100 billion per year; 75% of that cost is incurred by fewer than 5% of individuals with CLBP.[17] Patients with LBP comprise over 25% of all outpatient physical therapy visits,[18] and physical therapy accounts for 17% of the direct costs of LBP.[19]

Despite the high prevalence of LBP and the large body of literature on the topic, rates of LBP continue to increase.[17] As a result, researchers have searched for more comprehensive explanatory models that build on the large body of evidence, primarily examining BPA factors. Models such as the BPS model, CBT, and the FAB model expand on the BPA model by incorporating cognitive elements. The BPS model was first introduced by Engel in 1977 and suggests that pain and disability are influenced by biological, psychological, and social factors.[20,21] Cognitive behavioral theories of pain were popularized in the early 1980s and built on the work of behavioral psychologists.[22] These theories focused on the interplay between thoughts, emotions, and behaviors. Interventions focus on influencing thoughts and emotions in hopes of improving function and reducing disability.[7] The FAB model suggests that anxiety, excessive pain-related fear, reduced physical activity due to avoidance, and societal factors can affect the amount and duration of pain, increase disability, and limit function.[23,24] Although slightly different, these three models all build on the BPA model by adding cognitive factors, and they attempt to provide a more comprehensive understanding of chronic pain.

The importance of cognitive factors in individuals with LBP has been supported in the literature. Several studies have found that psychological risk factors have a modest influence on the development of LBP [3,25-27] and increase the risk of developing CLBP. [28,29] Picavet et al. surveyed 1,845 individuals with a 6-month follow-up and found that pain catastrophizing and kinesophobia were predictors of CLBP and associated with higher levels of pain levels.[30] In two systematic reviews, Wertli et al. found that FABs and pain catastrophizing had an impact on work-related outcomes, such as time out of work.[31,32] Cognitive factors are also associated with higher pain levels, increased disability,[8,33-36] and treatment success.[31,37-41] Changes in FABs are associated with reduced pain and improved disability,[8] and interventions targeting negative beliefs about LBP have been found to decrease pain, improve physical performance, lessen anxiety and depression, and reduce healthcare utilization.[42]

With the growing appreciation of the importance of patient cognitive factors, several authors have suggested that clinician attitudes and beliefs about LBP may have an impact on patient outcomes.[10,11,43-45] Clinicians whose beliefs are more BPA-oriented may provide advice and recommendations that limit physical activity and promote the development of psychosocial risk factors.[46,47] Although several studies have been performed regarding physical therapist attitudes and beliefs about LBP, the beliefs of physical therapists in the US are unclear and it is unknown if these attitudes and beliefs have an impact on patient outcomes.[46,48] The purpose of this proposed project is to investigate physical therapist attitudes and beliefs about LBP, identify factors that influence those beliefs, and determine if attitudes and beliefs have an impact on patient outcomes.

Significance

Approximately 80% of individuals will have LBP in their lifetime. Of those individuals, 70 to 90 percent will recover in 6 weeks[49] and approximately 10% will go on to develop CLBP.[50] Although most individuals with LBP recover, the majority of those individuals will have a recurrence of pain within a year.[43,51] Despite significant research, the rates of LBP in our society remain high, the cost continues to increase[17], and the best treatment approach is unclear.[52,53] There is a growing body of evidence suggesting that cognitive factors may have an important influence on LBP.[26,29] It has also been suggested that clinicians' thoughts and beliefs about LBP have an influence on recovery.[46,54] Understanding this relationship could lead to improved outcomes for patients with LBP.

A clinician's LPB-related attitudes and beliefs may influence the course of the disorder in several ways. One potential mechanism for this effect is the influence that clinician attitudes and beliefs have on the beliefs of their patients. A 2012 systematic review, including 17 articles from 8 countries, found strong evidence that patient beliefs about LBP were associated with the beliefs of their health care professionals.[55] A more recent qualitative study involving New Zealanders with LBP found that healthcare professionals had the largest impact on patient beliefs.[56] Participants in this study reported feeling uncertain about why they had pain and what they should do about it. These participants sought information from several sources, such as family, friends, and the internet, but they had the greatest confidence in the information provided to them by healthcare professionals. Clinicians who provided information and advice that focused on BPA factors, such as muscles and posture, and who suggested that certain activities be avoided, caused guilt, frustration, and worry in patients.[56] This suggests that a clinician who believes movement is dangerous and damaging to the back may talk and act in a way that increases a patient's fear and reduces their willingness to move. [56-58] These clinician-driven changes in fear avoidance, kinesophobia, and pain catastrophizing could lead to higher pain levels, increased disability, and an overall worse outcome for patients.[8,32,36,39,59,60]

Clinician attitudes and beliefs about LBP influence the advice they provide to patients and may affect the treatment choices they make. Several studies have found that clinicians who are more biomedically-oriented and who have lower movement and functional expectations advise patients to move less and limit work activities.[46,54,61-63] For example, Houben et al. measured the beliefs of 295 physical therapists in the Netherlands. They found that physical therapists with a biomedical orientation saw activities as being more harmful, and when provided with patient vignettes, were more likely to recommend activity limitations and work avoidance.[46] A qualitative study of 6 physical therapists and 12 patients reported that patient education and treatment decisions were closely related to the physical therapists' beliefs. The therapists involved in the study had strong BPA beliefs such has pain being caused by poor muscle control, stiffness, obesity, job duties, and disc injury. Treatment was aimed at correcting the BPA findings and prognosis was determined based on the ability to change the BPA factors.[47] These studies suggest that greater BPA-oriented beliefs increase the likelihood that a physical therapist will provide advice and treatment that is not aligned with current guidelines.[64] This could lead to worse outcomes or reduced clinical efficiency for patients treated by physical therapists who have BPA-oriented beliefs.

Physical therapist attitudes and beliefs about LBP also have an influence on the functional expectations physical therapists have for patients. [47] This phenomenon was first described by Rosenthal in 1963 and has been called "the expectancy effect."[65] Rosenthal observed that the expectations of an examiner had a significant impact on the speed rats could complete a maze.[65] When researchers thought they were testing highly intelligent rats, those rats finished the maze sooner than identical rats that were viewed as having normal intelligence. It is possible that this effect could carry over to the clinical setting, resulting in changes in outcomes based solely on the expectations of the healthcare provider. The clinical application of this effect was demonstrated in a study by Galer et al.; they found a significant correlation between a physicians' expectation that an injection would be effective and the actual change in pain after the injection.[66] This effect has also been observed in physical therapy students during an isometric lifting task. Students with high fear-avoidance who were tested on a lifting task by other students with high FAB had a 14.4 kg reduction in lifting capacity.[9] The exact mechanism(s) of this effect is unclear; however, a lack of clinical equipoise could lead to subtle changes in a clinician's verbal and non-verbal communication which, in turn, could influence patient performance. This could lead to worse outcomes for patients with LBP who are treated by physical therapists with BPA-oriented attitudes and beliefs.

Several studies have been published which look at the attitudes and beliefs of physical therapists and how those beliefs affect decision making. These studies have provided a theoretical basis for how the beliefs of physical therapists could influence patient outcomes. The vast majority of these studies have been performed outside the US and it is unclear if the beliefs of physical therapists within the US are similar to those of other countries. It is also unclear if beliefs have a meaningful impact on patient outcomes. A 2011 Swedish study of 42 physical therapists and 266 patients found that patient outcomes did not change after physical therapists underwent an 8-week class focused on psychosocial prognostic factors.[44] This may indicate that clinicians' beliefs do not have an impact on outcomes; however, the small sample size, questionable risk adjustment strategies, and focus on changes in physical therapist beliefs limit the conclusions that can be drawn from this study. Further investigation into the impact of physical therapist attitudes and beliefs on patient outcomes could help to determine if greater attention should be given to measuring and modifying the attitudes and beliefs of physical therapists.

Practical Application

If the attitudes and beliefs of physical therapists about LBP have an impact on outcomes, then educational interventions targeting these beliefs may lead to improved patient recovery. Entry-level education and post-professional courses aimed at improving physical therapist attitudes and beliefs could help to ensure that patients obtain the best recovery possible. It may also be important to screen physical therapists and student physical therapists for high-risk beliefs and target interventions at those clinicians whose beliefs may lead to worse outcomes. The identification of factors that influence the attitudes and beliefs of physical therapists will assist in developing strategies to improve them. If physical therapist attitudes and beliefs do not impact the outcomes of patients with LBP, efforts to change those beliefs may be an inefficient use of time and resources.

Specific Aims

1. Describe the attitudes and beliefs of US physical therapists regarding low back pain.
2. Determine if physical therapist knowledge about the physiologic mechanisms of pain is aligned with current evidence.
3. Determine factors that influence physical therapist attitudes and beliefs regarding low back pain.
4. Determine if physical therapist attitudes and beliefs are associated with the outcomes of patients with low back pain.

Research Question and Hypothesis

Questions:

1. What are the characteristics of the physical therapists who participated in the study?
2. What are the low back pain related attitudes and beliefs of US physical therapists?
3. Do physical therapists have pain science knowledge that is aligned with current evidence (as measured by the Revised Neurophysiology of Pain Questionnaire)?
4. What factors are associated with physical therapist attitudes and beliefs about low back pain?
5. Are physical therapist attitudes and beliefs associated with the outcomes of patients with low back pain?

Research Hypothesis:

H1 Physical therapist traits, such as a personal history of low back pain, a personal history of invasive interventions for low back pain, a lack of board certification or residency/fellowship training, and limited knowledge about pain mechanisms, will be associated with greater BPA-oriented attitudes and beliefs.

H2 Patients with low back pain treated by physical therapists with BPA-oriented beliefs will improve less than those treated by physical therapists with lower BPA-oriented beliefs.

Definitions

Back pain: An unpleasant sensory and emotional experience that occurs in an area from the first thoracic vertebrae to the sacrum or is associated with a disorder of those areas.

Low back pain: An unpleasant sensory and emotional experience that is located below the ribs and above the gluteal folds.

Bio-pathoanatomical model: An explanatory model that addresses the origins of back pain in terms of tissue and biomechanical pathology.

Biopsychosocial model: An explanatory model that focuses on the origins of back pain in terms of tissue and biomechanical pathology, social, psychological, and behavioral factors.

Attitudes and beliefs (about low back pain): The attitudes and beliefs of physical therapists about the connection between tissue damage, low back pain, and function.

Summary

LBP is a common problem that results in disability and financial burden. Despite significant scientific investigation, the cause of LBP remains unclear and there is a lack of highly effective treatment strategies. There has been a growing interest in investigating the influence of psychological and social factors on LBP. Studies have suggested that factors such as pain catastrophizing and fear avoidance can have an influence on the development and prognosis of LBP. More recently, it has been proposed that clinician attitudes and beliefs about the relationship between pain, tissue injury, and function may have an impact on the outcomes of patients with LBP. This dissertation will investigate the attitudes and beliefs of physical therapists and their influence on the outcomes of patients with LBP.

Chapter 2: Literature Review

Introduction

This chapter includes a review of the concepts and literature pertaining to the impact of clinician attitudes and beliefs about low back pain (LBP). The chapter will start by describing LBP and detailing the impact this disorder has on individuals and society. The evolution of explanatory models for LBP from a pathoanatomical-dominated model to a broader biopsychosocial model will also be covered. Next, the negative impact of certain patient-oriented beliefs will be discussed which will lead into a discussion of the potential impact of clinician LBP-related attitudes and beliefs have on patient outcomes. Finally, current gaps in the literature will be highlighted and the purpose of this dissertation will be explained.

Low Back Pain

Pain has been defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” by the International Association for the Study of Pain.[67] The low back is not well defined as an anatomical region, but is traditionally associated with the lumbosacral spine. LBP can have various definitions and has been described as pain that is located below the ribs and above the gluteal folds.[68] Lower back dysfunction may also result in symptoms that are felt in other areas of the body. These symptoms can be concurrent with LBP or arise independently. A common example is lower extremity referred pain that has an etiological origin in the LBP.

Classification of LBP in the literature is variable and includes methods based on duration of symptoms, location of symptoms, treatment response, pathoanatomical characteristics, or radiographic abnormalities.[69-71] Symptom duration is one of the most commonly used classification systems in the literature and divides patients into three broad categories: acute, sub-acute, and chronic. Exact definitions can vary between studies, but, authors generally describe acute LBP as pain lasting less than 4 weeks, sub-acute LBP as pain lasting between 4 and 12 weeks, and chronic LBP as pain lasting greater than 12 weeks.[64,71]

LBP is the most common musculoskeletal disorder and is estimated to affect over 2 billion people globally.[1,72] A 2016 article on the global impact of disease and injury found that LBP has remained the number one cause of disability over the last 25 years.[73] The prevalence of LBP varies widely across studies and between countries, and the one-year prevalence has been reported to be as low as 7.0% (Denmark) and as high as 76.0% (Germany).[1] In the United States (US), studies have found the one-year prevalence of LBP to range from 10.3%[74] to 56%[75], with a lifetime prevalence up to 80%.[1,72,76,77] Females have higher rates of LBP than males and LBP prevalence tends to have a curvilinear relationship with age.[1] When looking at all LBP, prevalence is highest in middle age;[1,73,76] however, severe LBP tends to increase steadily with age.[1] Chronic low back pain (CLBP) is less prevalent than acute or sub-acute LBP, with ranges from 3.9%-20.0%.[15] Although CLBP occurs less frequently, it accounts for 75% of the more than $100 billion dollars spent on LBP each year in the US.[17]

Explanatory Models

Traditionally, LBP has been seen as a tissue-based disorder.[20,78] Researchers and clinicians have focused on pathoanatomical sources of pain and dysfunction, such as discogenic pathology and degenerative changes. Studies investigating bio-pathoanatomical (BPA) influences on pain have improved our understanding of anatomical and physiological changes that may influence LBP; however, these factors have not fully explained the complex nature of the condition. [4-6,79] For example, BPA models of LBP have not been able to adequately explain the disconnect between structural changes in the back and the heterogeneity of patient signs and symptoms.[3,4,80] As a result, clinicians and researchers searched for broader explanatory models that could potentially lead to new areas of research and more effective interventions to prevent and treat LBP. In 1977, George Engle described the conflict between a medical model of disease and the needs of psychiatrists for a broader view of disease and disability.[20] He felt that all of medicine was in a crisis due to an "adherence to a model of disease no longer adequate for the scientific tasks and social responsibilities of either medicine or psychiatry."[20] He argued that the medical model's assumption that disease can be completely captured by measurable bio-anatomical factors was faulty, and that social, psychological, and behavioral factors should be considered. Engle proposed that medicine move away from a reductionist biomedical model and proposed the biopsychosocial model of disease (BPS).[20] This model stresses that simply addressing BPA factors may not be sufficient to return patients to full health. Instead, health and healing are predicated on treatment of biological, psychological, social, and behavioral factors.

Around the same time that Engle was proposing his BPS model, Fordyce was describing behavioral-based interventions for treating patients with chronic pain.[81-84] Fordyce suggested that pain behaviors were operant and influenced by environmental factors. For example, he described how activity tolerance in patients with pain is influenced by contextual factors, such as verbal reinforcement, attention, and social context.[81] Since pain cannot be directly measured or observed, Fordyce suggested that interventions should focus on the emergent behaviors that were amenable to observation. Behaviors were said to initially be responses to actual or potential tissue damage; however, chronic pain was seen as a persistence of this behavior beyond the threat to the tissue.[83] Behavioral-based interventions were not aimed at changing nociception, but were focused on influencing pain expressions such as disability and suffering.[83]

Gordon Waddell was one of the first practitioners to write about the use of BPS and behavioral models for the treatment of patients with LBP[78,85] His 1987 article in Spine highlighted the apparent disconnect between the physical aspects of LBP and the resulting pain and disability.[78] Waddell described a treatment approach that targeted psychological and behavioral aspects of the disorder. Since that article, there has been a growing interest in the impact of psychological and behavioral factors on low back pain. Guidelines now suggest that psychological factors be considered,[64,86] and treatments to address psychological and behavioral aspects of LBP, such as Cognitive Behavioral Therapy (CBT),[87] pain neuroscience education (PNE),[42] and graded exposure[88] have continued to grow in popularity.

Patient Beliefs

In addition to more psychologically informed treatment, there has been an expanding body of literature, and growing appreciation for, the importance of patient beliefs in the examination and treatment of musculoskeletal conditions. Fear-avoidance beliefs (FABs) and pain catastrophizing (PC) are two of the most commonly studied topics in this area and may play an important role in the development, persistence, and treatment of LBP.

The fear-avoidance model was first described by Lethem in 1983 and suggests that a patient's attitudes and beliefs about LBP influence the development and continuation of pain and disability.[24,89] Under this model, fear of pain can lead to either avoidance or confrontation behaviors. Patients who fall more on the confrontation side of the continuum have less disability because they continue to move and function despite pain. Those who demonstrate more avoidance behaviors reduce their physical activity and attempt to avoid movement and activity that does or may cause pain.[24] The model predicts that avoidance behaviors will lead to increased pain, higher levels of disability, and a greater chance of developing chronic pain.

The concept of catastrophizing in medicine was first introduced in the 1950s and was seen as an irrational belief about the severity of a condition or problem.[90] PC occurs when patients see their pain and/or resulting disability as greater than it actually is. This exaggerated negative belief about pain is thought to result in higher levels of pain, greater disability, and is likely related to FABs.[91] Three dimensions of PC have been identified: rumination, magnification, and helplessness.[92] Rumination is excessive thought and worry about pain, magnification is the perception that the condition is more serious than it is, and helplessness is the feeling that nothing can be done about the condition. In general, studies have supported the hypothesis that patient's beliefs about LBP have an impact on the condition. FABs and PC have been implicated as factors impacting the development of LBP,[26] the level of disability,[93] pain intensity,[94] conversion to chronic pain,[28] treatment success,[95] and overall prognosis.[96]

Development of Low Back Pain

There have been several studies that implicate FABs and PC as risk factors for the development of LBP in asymptomatic individuals. In a prospective study of 415 participants without spine pain, Linton et al found that those who scored above the median (9 points) for

FABs were two times more likely to develop back pain and at a 1.7 times greater risk of having lower physical functioning in the subsequent year.[27] In a similar study, Picavet et al. found that high levels of FABs and PC predicted the development of LBP in a pain-free cohort over a 6 month period.[30] In a systematic review, Linton identified 37 prospective studies that investigated risk factors for the development of neck and back pain. Psychological factors, including FABs, were consistent risk factors for the development of LBP. Four studies investigated the impact of FABs and/or PC, and all four found that they played a role in predicting the development of pain.[26]

Disability

Higher levels of FABs and PC in patients have been found to be related to higher disability;[8,28,94,97-103] for example, in a cross-sectional study of 96 participants with acute LBP, FABs were found to be strong predictors of a subject's ability to perform a lifting task.[104] In fact, FABs and PC were better predictors of lifting capacity than Roland-Morris Disability Questionnaire scores and pain intensity.[104] A study of 211 participants with chronic pain found that patients with higher PC reported more disability and greater psychological distress.[101] Grotle et al. examined FABs, distress, and disability in 356 participants with acute or chronic LBP. Patients with chronic LBP had more FABs and those beliefs were associated with greater disability and more work absenteeism.[93] These findings suggest an association between patient beliefs and disability. The cross-sectional nature of the studies limits the ability to make inferences about a cause and effect relationship. It is possible that higher levels of disability result in elevated FABs and PC. Another limitation of these studies is the over reliance on self-report measures of disability. FABs and PC may influence patients' self-reports of disability, irrespective of the patients' actual functional abilities. To avoid problems with self-reporting bias, future studies should include direct measurements of function, such as the lifting task utilized by Swinkels-Meewisse et al.[104] The association between disability, FABs, and PC is a fairly consistent finding in the literature; however, the relationship is generally weak to moderate at best [8,28,94,97-103] Given the complex nature of LBP, it is not surprising that patient beliefs may only explain a portion of the variability in disability. Despite only having a modest correlation, patient beliefs may be an important factor given that several studies have found FABs and PC to be the strongest single predictors of disability. [28,93,98,104]

Pain Intensity

FAB and PC have been shown to influence pain intensity in patients with musculoskeletal pain. [8,94,101,102,105,106] In 1998, Sullivan et al. studied 86 participants with persistent pain disorders (75% with LBP). PC in these participants was moderately correlated with several factors, including present pain intensity (0.46), disability (0.55), depression (0.47), and anxiety (0.51).[94] This study suggests that there is a relationship between pain and PCS; however, due to study limitations it is unclear if this relationship is causal. A causal link between PC and pain intensity was supported in a prospective study published by Sullivan et al.[107] In this study, PC was measured in 80 healthy college students without pain. Experimentally induced pain was measured using a visual analog scale and pain behaviors were recorded by independent raters who watched video recordings of the session. The results demonstrated PC was a predictor of pain intensity and pain behaviors for the female participants in the study. The prospective nature of the study suggests that PC may have an influence on pain intensity ratings and behaviors. This relationship was only seen in the female participants (n=42) and it is unclear if the finding can be generalized to individuals with non-experimentally induced painful conditions. Peters et al investigated the relationship between pathology, FAB, PC, pain intensity, and disability in 100 patients with non-specific LBP. [105] Disability had the strongest association with pain intensity; however, FAB and PC explained 4-10% of the variability in pain intensity. Overall, only 25% of the total variance in pain intensity was explained by the factors included in this study. This suggests that factors other than PC, FAB, pathology, and disability play a significant role in predicting pain intensity. Similar studies by Turner et al.[102] and Severeijns et al.[101] found a correlation between higher levels of PC and greater pain intensity in patients with chronic low back pain. Nearly all the studies investigating the relationship between patient beliefs and pain intensity in participants with painful conditions were retrospective, relied on self-reported measures, and did not include long-term longitudinal follow-ups. As a result, conclusions about cause and effect, and the long-term consequences of patient beliefs on pain intensity, cannot be made.

Chronicity

Patient beliefs about musculoskeletal pain may also have an impact on the development of chronic pain; [24,28-30,98,108,109] however, the literature on this topic is limited by small sample sizes, prospective designs and is lacking in long-term longitudinal studies. The proposed hypothesis is that certain patient beliefs increase the risk of developing CLBP. The exact mechanism for this connection is unclear, but it is possible that patient beliefs influence neurophysiology or behavior in a way that increases the risk of developing long-term LBP symptoms. Several published studies have demonstrated a relationship between patient beliefs and CLBP. For example, Fritz et al. followed 78 participants for 4 weeks to determine factors that predicted continued symptoms.[98,109] After 4-weeks, 29% of the participants remained on work restrictions. FABs were the best predictors of work status and disability at the 4-week follow-up.[98,109] Klenerman et al. followed a sample of 300 patients with acute LBP for 1 year.[28] Measurements were taken at one week and two months to identify factors that may predict outcomes at 12 months. Only 41% of the participants were measured at all three time points and one-year follow-up was obtained for 54% of the sample. FABs were the strongest predictor of persistent LBP over the 12-month period, explaining 25% of the variability.[28] Picavet et al. also performed a longitudinal study of patients with LBP in hopes of identifying predictors of CLBP.[30] The follow-up time was half that of the Klenerman study; however, it involved a significantly larger sample size. Eighty five percent of the 1,845 surveyed participants (1,571) responded to the survey and 26.2% reported LBP. FABs and PC predicted continued LBP, LBP severity, and disability with odds ratios ranging from 1.7 to 3.0. [30] These studies investigating the influence of patient beliefs on the development of chronic LBP suggest that beliefs may be a risk factor for chronicity. These studies are limited by short-term follow-ups, patient drop-out, missing data, and a reliance on self-report.

Treatment Success and Prognosis

The impact of patient beliefs on prognosis and treatment success has been investigated by several authors. [31,59,95,96,98,100,110-114] The majority of these studies have shown that higher levels of FABs and greater PC correlate with a worse prognosis and reduced effectiveness of traditional interventions utilized by physical therapists. A 2006 systematic review on FABs and LBP prognosis included 9 articles, 8 that were classified as having acceptable quality.[112] This review included prospective studies that investigated the impact of FABs on the prognosis of patients with acute and subacute LBP. Three studies from this review demonstrated no association between FABs and prognosis. The other studies suggested a relationship, but the effect sizes were generally small. In 2007, Mallen et al. performed a broader systematic review that investigated prognostic factors for patients with musculoskeletal pain. [95] They identified 11 prognostic factors including higher baseline pain intensity, multiple pain sites, lower social support, and greater movement restriction. Two of the identified factors, higher somatic perceptions/distress, and coping strategies, overlap with the FAB and PC constructs. In 2014, Wertli et al. published two systematic reviews investigating the influence of patient beliefs on prognosis.[31,32] One of these reviews investigated the influence of FABs on patients with non-specific LBP. [65] The review included 21 studies and concluded that high FABs were prognostic of poorer outcomes for patients with sub-acute pain. The strongest connection was the association between FABs and the risk of work-related disability.[31] The review did not find FABs to be prognostic for patients with LBP less than 2-weeks or greater than 3-months. The other review by Wertli et al. investigated the influence of PC on the prognosis of patients with LBP. [66] The authors included 16 studies and found that most of the studies reported that PC was predictive of pain and disability in patients with acute, sub-acute, and chronic LBP. Both the reviews by Wertli and colleagues were limited by inconsistencies in the included studies, short follow-ups, and a reliance on self-reported measures. Due to the variability in study design, neither review included a meta-analysis of the data.

Similar to overall prognosis, patient beliefs may have an impact on the response a patient has to treatment.[59,96,113,115,116] For example, a patient who has fear about movement may be less likely to respond positively to an exercise based intervention. Bergbom studied 297 patients receiving physical therapy and found a relationship between higher levels of PC and a lack of improvement with interventions.[115] Al-Obaidi et al. also found that FABs were predictive of patients who did not respond to an exercise-based intervention. [96] In contrast, Underwood et al performed a secondary analysis of 1334 participants who participated in the UK BEAM trial. They found that FABs were predictive of overall outcomes, but they were unable to specifically predict response to treatments such as exercise and spinal manipulation.[113] In 2014, Wertli et al. performed systematic reviews to determine if FABs and PC were moderators or mediators of treatment efficacy.[59,116] The reviews included 17 studies on FABs and 11 studies on PC, with study quality ranging from moderate to high. The reviews concluded that a reduction in FABs was a mediator of reduced disability in patients with LBP for less than 6-months[59] and a reduction of PC mediated improvements in pain and disability.[116] The moderating effect of FABs and PC on treatment success were less consistent among the studies included in the reviews, which may have been due to a lack of power. [59,116] These results suggest that changes in patient beliefs may be one of the factors that influence a patient's response to treatment.

Interventions for FABs and PC

Given the apparent influence of FABs and PC on LBP, there has been interest in interventions that target those beliefs. The current literature on this topic is limited in both quantity and quality; however, the available literature suggests that FABs and PC can be changed and those changes are associated with meaningful clinical improvements for patients with LBP.[42,87,117-119] Two commonly utilized interventions that are aimed at addressing patient beliefs are Cognitive Behavioral Therapy (CBT) and Pain Neuroscience Education (PNE). CBT includes a large class of psychological treatments that attempt to address cognitive and behavioral aspects of pain, such as catastrophizing and avoidance behaviors.[7] PNE is an educational intervention that teaches patients about the neurologic origins of pain, emphasizes the disconnect between tissue damage and pain, and seeks to reassure patients that pain reduction is possible.[119,120] Studies on the effectiveness of CBT have generally found that it is a useful intervention for patients with LBP.[87,121] A 2015 meta-analysis on the use of CBT for the treatment of non-specific LBP found CBT resulted in greater improvement in disability and pain when compared to a wait-list and European guideline-based active treatments that included exercise. [122] Although significant, the positive effects of CBT on LBP were consistently small to moderate at best.[122] A 2018 systematic review investigating CBT for the treatment of subacute LBP found that 5 of the 6 included studies favored CBT.[87] The included studies used different CBT protocols and diverse outcome measures, making it difficult to compare the findings. Comparison groups were also variable and included individual exercise, group exercise, primary care management, and no treatment. Similar to other studies on CBT, the effects of the intervention were modest in patients with subacute LBP.[87]

Similar to CBT, several studies have shown that PNE has a positive influence on patients with LBP. Moseley et al. compared PNE combined with physical therapy (PT) to care provided by general medical practitioners and found significant improvements in pain and disability at the one-year mark.[123] A more recent multicenter randomized controlled trial found that PNE plus exercise was more effective than biomedical focused education and exercise.[124] There were small to medium effects for pain, symptoms of central sensitization, disability, pain beliefs, and function in patients with CLBP. Several other studies have been performed on PNE and it has been shown to be associated with reduced pain,[125,126] improved function,[126,127] decreased FABs and PC,[127-130] reduced anxiety and/or depression,[127] improved physical performance,[128,131] and reduced healthcare utilization.[130,132] The influence of PNE on CLBP was also supported by a 2018 meta-analysis that included 7 randomized controlled trials.[133] The analysis found moderate evidence for a small to moderate short-term improvement in pain with PNE and low level evidence for a small to moderate short-term improvement in disability. There was also low-level evidence for small to moderate effect on pain and disability at 3-months. Unlike these studies on CLBP, Traeger et al. found that PNE did not have a positive effect on patients with acute LBP.[134] They performed a randomized placebo-controlled trial on the use of PNE in 202 patients with acute LBP. Patients were randomized to receive PNE or placebo education, which included active listening but no material or advice. PNE was no better than the placebo education at reducing pain intensity at 3, 6, or 12 months. The PNE group did have a small reduction in disability (7%) at 1 week and 3 months, but this reduction may not be clinically meaningful, and the difference was not present at the 6- or 12-month follow-up.

Clinician Beliefs

Based on the growing body of literature demonstrating the importance of patient-oriented psychological factors, including beliefs, it has become commonly accepted that clinicians should consider cognitive and psychological influences when treating patients with LBP.[64,71] It has also been proposed that cognitive and psychological factors within clinicians may have an influence on the recovery of patients with LBP.[55,135] This evidence is centered on the attitudes and beliefs of clinicians about the relationship between LBP, tissue damage, and functional expectations.[10,136] Proponents suggest that clinicians who draw a stronger relationship between pain and tissue damage, and who have lower functional expectations for patients with LBP, have a negative impact on the recovery of their patients.[10,11,46,137] There are several potential mechanisms for this negative effect and the evidence on this topic is still evolving.

Impact on Clinician Behaviors

The most direct potential influence of clinician attitudes and beliefs on the recovery of patients with LBP is the effect these attitudes and beliefs may have on the actions of the clinician. Twenty-three studies were identified that investigated the relationship between clinician attitudes and beliefs about LBP and their clinical actions.[43,45-48,54,63,138-153] These studies included general practitioners, orthopedic surgeons, rheumatologists, chiropractors, manual handling advisors, physical therapists, and physical therapist students across 10 different countries (see Table 1). Twenty of the studies found a relationship between clinician attitudes and beliefs and clinical actions. All 20 of these studies found that clinicians who have lower functional expectations and/or stronger BPA-oriented beliefs were prone to clinical actions that encouraged less activity.[43,45-48,54,63,138-140,142,144-150,152,153] For example, Coudeyre et al. measured the FABs of 864 general practitioners (GPs) in France and surveyed them about their usual actions when treating patients with LBP.[142] The beliefs of GPs were measured using the Fear Avoidance Beliefs Questionnaire for Healthcare Workers (FABQ-HC)[62] and clinical practice was measured using five questions, which inquired about the information GPs provided to patients with LBP, the referral practices of the GP, the length of sick leave prescribed for acute LBP, the advice given about physical activity, and the GP's attitudes regarding job adaptations, sick leave prescription, and physical activity for patients with chronic LBP. Approximately 16% of GPs were categorized as having high FABs (>14 on FABQ-HC Physical Activity subscale); GPs with higher FABs were more likely to suggest bed rest (p<0.001), recommend longer work sick-leave (p<0.05), and were less likely to encourage patients to maintain a tolerable level of physical activity (p<0.001). Lower FABs scores were associated with greater familiarity with functional restoration programs (p=0.002), a larger focus on patient education (p=0.004), referral to back schools (p=0.01), and recommendations for less than 8-days of sick leave (p=0.003). Bishop et al conducted a similar survey-based study of 455 GPs and 580 physical therapists in the United Kingdom.[48] Attitudes and beliefs were measured using the Pain Attitudes and Beliefs Scale (PABS-PT) and clinical practice was determined by asking questions about a patient vignette. The PABS-PT contains two subscales and scores indicate whether a clinician has beliefs that are more biomedically- or biopsychosocially-oriented. The responses to the clinical practice questions were categorized as being strictly in-line, broadly in-line, or not in-line with guideline recommendations. Strictly in-line advice included return to work, perform usual activities, and avoid bed rest. Not in-line advice included stay out of work until pain disappears, limit physical activity until pain disappears, and rest in bed until pain disappears. Advice labeled as not in-line for work, activity, and bedrest was given by 28.1%, 6.6%, and 0.9% of respondents respectively. Mean biomedical scores were higher (28.3, 30.6, 33.5) and mean biopsychosocial scores were lower (34.1, 33.3, 31.8) for clinicians whose work advice was labeled as divergent from guideline recommendations (p<0.001). The association between PABS-PT scores and advice about activity and bedrest were not analyzed due to the low number of respondents who provided advice that was labeled not in-line. Clinicians who scored high in biomedical and low in biopsychosocial on the PABS-PT made up the greatest percentage of individuals who provided advice not in-line with guidelines for physical activity and bedrest.

Houben et al. performed a study looking at attitudes and beliefs about low back pain, harmfulness perceptions about physical activity, and recommendations for activity of 295 therapists (manual therapists n=113, physiotherapists n=69, McKenzie therapists n=57, Chiropractors n=26, and others n=30) in the Netherlands.[46] Attitudes and beliefs were measured using the PABS-PT and harmfulness judgments about physical activity were determined using the Photograph series of Daily Activities (PHODA), which consisted of 41 pictures of individuals performing common tasks. Study participants ranked the harmfulness of the PHODA tasks on a 7-point scale, ranging from "not harmful at all" to "extremely harmful." Recommendations for physical activity were determined using three patient vignettes. Study participants were asked to rate the level of pain, amount of pathology, and the recommended level of activity and work for each patient vignette. Scores on both PABS-PT subscales were predictors of PHODA harmfulness ratings ($p<0.01$) and recommendations for physical activity ($p<0.01$) in the expected direction. The biopsychosocial subscale was also predictive of work recommendations ($p<0.05$).

There were three studies that failed to find a connection between attitudes and beliefs and the clinical actions of healthcare providers. Epstein et al. examined the FABs of 149 Israeli primary care providers and surveyed them about their knowledge and readiness to implement LBP guidelines.[143] There was no association between FABs and the measured guideline variables, which suggests no connection between clinical actions and attitudes and beliefs. This study was limited by the high overall guideline knowledge of the sample, which may not have been representative of the population. The lack of variability in guideline knowledge may have also increased the chance of a type II error due to the small number of participants with poor guideline knowledge. The questions about clinical behaviors used in this study were oriented around guideline knowledge and did not ask about actual behavior. As a result, the findings of this study suggest no connection between guideline knowledge and attitudes and beliefs, but it is unclear if clinical behaviors were correlated. Another study which did not find a connection between attitudes and beliefs and clinical action was performed on 47 student physical therapists and recent graduates in Ireland.[141] There was no connection between activity and work advice given for three patient vignettes and the biomedical and/or biopsychosocial orientation of the participants. The final study that failed to find a relationship between actions and beliefs determined that beliefs were not correlated with the number of sickness certifications issued by GPs in the United Kingdom.[151] This was the only study of the 20 that directly measured clinical behaviors and did not rely on self-report or hypothetical patients.

In general, the literature suggests that the attitudes and beliefs of clinicians have an impact on the type of clinical actions they take. Those clinicians with higher FABs, lower functional expectations, greater biomedically-oriented beliefs, and less biopsychosocial orientation are more likely to suggest that patients limit their activity. This indicates that clinician attitudes and beliefs may play a role in the outcomes of patients with LBP. Despite this consistency, several limitations in these studies should be considered when generalizing the results to physical therapists. A major limitation is that only eight of the studies were performed exclusively on physical therapists, and of those eight, only one included physical therapists from the US. As a result, it is unclear if the bulk of the studies on this topic can be generalized to physical therapists in the US. Another significant limitation is the reliance on self-reported measures. Only one of the 23 studies included a direct measurement of clinician behavior and that study did not find a connection between beliefs and behaviours.[151] It is unclear if the self-reported measures of clinician behavior were reliable and valid. Even if clinician attitudes and beliefs had an impact on the behaviors of clinicians, it is unclear if these effects resulted in a significant influence on patient outcomes.

Impact on Patient Beliefs

Clinician attitudes and beliefs about LBP could impact patient outcomes more indirectly by influencing the beliefs of patients.[55] As discussed previously, there is evidence that patient beliefs influence their experience of LBP and seem to have an impact on outcomes, such as pain intensity and disability.[32,95] If clinician attitudes and beliefs have an effect on the beliefs of patients, it is possible that this influence will have an impact on patient recovery. Six studies were identified that investigated the impact of clinician attitudes and beliefs on the beliefs of patients.[47,56,144,154-156] All six of these studies suggest that patient beliefs were influenced by the beliefs of the clinicians who cared for them (see Table 2). A good example of this influence was provided by Darlow et al. in a qualitative study of 23 patients with LBP from New Zealand.[56] These patients, who participated in semi-structured interviews, described several factors that influenced their beliefs about LBP, including the media, family and friends, previous experience and healthcare professionals. Participants reported that healthcare professionals had the largest impact on their beliefs about the source and meaning of pain, and on their expectations for recovery. Clinicians who stressed protective avoidance strategies for the back and who focused primarily on BPA explanations for LBP, such as faulty alignment, ligament sprains, muscle dysfunctions, and postural factors, caused patients to feel guilt, frustration, and worry. For example, in response to receiving a diagnosis of a lumbar strain, one participant stated, “when I get that sharp pain, I guess that I’ve moved in a way that’s continually putting strain on an area of the muscle that I’ve damaged….my assumption would be that I was making it worse.”[56] Patients also reported that BPA-oriented clinicians encouraged them to focus more on their back pain and promoted an attitude of protection. One patient who was told by a chiropractor that his back was out of alignment stated, “the only thing that was going through my mind is the seriousness of my dis-alignment…I was really petrified.” Clinicians who focused on reassurance and activity promoted increased confidence, a positive attitude towards activity, and higher expectations for recovery. Poiraudeau et al. surveyed 286 rheumatologists and 443 of their patients to determine their beliefs about LBP.[144] Physician beliefs were measured using the FABQ-HC and patient beliefs about LBP were measured using the Fear Avoidance Beliefs Questionnaire (FABQ). An association was found between patient FABs about physical activity and lower patient educational level, workplace physical demands, the patients’ perceived level of disability, and physician FABs. High physician FABs were the strongest predictor of elevated patient fear of activity with an odds ratio of 5.92 (95% confidence interval of 1.3-26.32). It is unclear from this data if physician beliefs caused the increased FABs in patients; however, based on the study by Darlow et al. it appears possible.[56]

A similar correlation between healthcare provider attitudes and beliefs and patient beliefs was found in a large study of Norwegian patients and clinicians.[154] Four hundred and sixty nine healthcare workers (physical therapists (n=255), physicians (n=193), and chiropractors (n=21)) and 1502 patients were surveyed to determine their beliefs about LBP.

Patients were recruited using phone calls to 2,717 residents of three counties in Norway. Questionnaires were sent to all the practicing physicians (n=414), physiotherapists (n=663), and chiropractors (n=28) in the counties. Both clinician and patient beliefs were identified using six statements that mirrored recommendations made by Norwegian guidelines for acute LBP or messages contained in a recent media campaign. The six statements were: 1) "if you have a slipped disc you should have surgery," 2) "radiograph and newer imaging tests can always find the cause of pain," 3) "bedrest is the mainstay of therapy," 4) "in most cases, back pain recovers by itself in a couple of weeks," 5) "back pain recovers best by itself," and 6) "one recovers faster from back pain if one continues at work or returns as soon as possible." Survey respondents rated their agreement with the statements on a 5-point scale, ranging from totally disagree to totally agree. Overall, clinician beliefs were in-line with the guideline recommendations and there were not significant differences between the various provider types. The exception was with statements four and five, which asked about the natural course of LBP. None of the chiropractors agreed with statement five and 71.4% disagreed with the statement. Only 4.8% of chiropractors agreed with statement four, 57.1% were unsure, and 38.1% disagreed. These responses were significantly different than the responses given by physical therapists and physicians, who were more likely to agree with the statements (p=0.001). Patients who reported being treated by chiropractors were also more likely to disagree with statements four and five than patients who were treated by physical therapists or physicians (p=0.001). As with the study by Poiraudeau,[144] it is unclear if this association indicates a causal relationship; however, it is plausible that the beliefs of chiropractors had an influence on the beliefs of their patients. It is also possible that BPA-focused chiropractors tend to attract patients who have similar attitudes and beliefs. Based on this limited data, it is possible that clinician attitudes and beliefs about LBP have an influence on the beliefs of patients. If patients develop higher FABs or PC due to interactions with healthcare providers, patient prognosis could be lower.

Impact of Expectations

There may be other, indirect ways that clinician beliefs influence the outcomes of patients with LBP. One of these may be the impact of clinicians' expectations about LBP and treatment efficacy. The influence of expectation on an outcome was first described by Rosenthal in the 1960s and has been labeled the observer-expectancy effect.[65] Rosenthal observed that when his lab assistants believed that a rat was more intelligent, the rat was able to finish a maze faster than identical rats that were viewed as normal. This observation implies that the expectations of a tester, or perhaps a clinician, could influence the performance of a subject or patient. Galer et al. tested this phenomenon in a clinical setting by investigating the effectiveness of intravenous injections and nerve blocks for 46 patients with chronic pain.[66] Patients treated by physicians who expected the intervention to work were more likely to have a positive outcome ($r=.42$). A lack of clinical equipoise was also found to be a factor in outcomes after treatment with acupuncture. Witt et al examined the influence of 2781 physicians' expectations on pain reduction in 9900 patients after receiving acupuncture treatments.[157] When added to the regression model, physician expectation had a small, but significant impact on outcomes. Participants treated by physicians who expected substantial improvement with accupuncture had less pain and better functioning after treatment. This effect was independent of participants' baseline characteristics, which suggests the clinician expectations were not based on observed patient prognostic factors. A study of student physical therapist in the Netherlands also suggests that clinician expectations may influence outcomes.[9] In this study, participants who were tested on a lifting task by testers with higher FABs had significantly lower lifting capacity. If the lifters also had high FABs, the lifting capacity was reduced by 14.4 kg versus an 8 kg reduction if the lifter did not have elevated FABs. This suggests that clinicians with suboptimal beliefs may have the largest negative impact on patients who share those beliefs.[9]

The mechanism by which clinician expectations influence patient outcomes is not fully understood. It is possible that clinicians act differently based on their expectations and these actions may have a direct or indirect influence on patients. These changes in clinical behavior may be overt, such as changes in interventions, but the studies discussed above suggest that the influence may be more subtle. The clinicians' expectations may cause slight changes in verbal and non-verbal communication, which subconsciously influences the patient.[158] Rosenthal proposed that the researchers' expectations about the intelligence of the rats caused the testers to handle the rats differently.[65] This slight change in handling may have influenced the rats and caused them to be faster through the maze. It is reasonable to think that clinician expectations may influence their communication and handling of patients. These changes may influence outcomes by modifying the patient's confidence in the provider and the interventions.[158-160]

Impact on Outcomes

The research previously discussed provides indirect support for the hypothesis that the outcomes of patients with LBP can be influenced by the attitudes and beliefs of clinicians. This effect may be mediated by an impact on clinician clinical behaviors, by changes in patient beliefs, and/or changes in clinician or patient expectations. Despite the indirect support for the hypothesis, direct evidence for a connection between clinician beliefs and patient outcomes is lacking. One challenge is that factors influencing outcomes are numerous and complex,[161,162] which makes it difficult to identify individual factors, especially if they only have a small impact on outcomes. Four studies that investigated the impact of healthcare workers' attitudes and beliefs about LBP on patient outcomes were identified.[144,148,163,164] Only one of the four studies concluded that clinician attitudes and beliefs had an impact the outcomes (see Table 3). This study by Beneciuk et al. put 6 physical therapists through an education session emphasizing a stratified treatment approach (including 8 hours on psychologically informed treatment) and 6 physical therapists through standard education.[164] The physical therapists were then asked to treat patients based on the education they received and outcomes were obtained for their patients after 4 weeks. Physical therapists in the stratified education group had changed their attitudes and beliefs and patients treated by those physical therapists had greater improvements in pain and disability; however, it is unclear if the improved outcomes were a result of changes in the clinician beliefs. The physical therapists were instructed to treat based on the stratified education and it is unknown if the physical therapists would have changed their clinical behaviors simply based on changes in their attitudes and beliefs. There was also minimal change in the physical therapists' attitudes and beliefs after the education and it is unclear if those small changes had an impact on clinical behaviors or outcomes. The authors did not directly analyze if changes in attitudes and beliefs correlated with outcomes. In contrast to the findings of this study, Overmeer et al. did not find a relationship between changes in physical therapists' attitudes and beliefs and patient outcomes after an educational intervention.[163] In this study, 42 physical therapists were randomized to an education intervention focused on BPS aspects of pain or to no education. Unlike the previously discussed study, participants in this study were not specifically instructed to follow a particular treatment protocol when treating patients. The outcomes of the patients from physical therapists in both groups were collected at baseline and at 6 months and there were no statistically significant differences between the groups; furthermore, the impact of physical therapist attitudes and beliefs on outcomes was not affected by patient levels of PC or depression. The authors did note a trend towards better outcomes in patients with high PC and depression who were treated by physical therapists in the intervention group, but that trend was not significant. The two other identified studies also failed to show that healthcare provider attitudes and beliefs had an impact on outcomes. Poiraudeau et al. measured the outcomes of patients with LBP who were treated by 266 rheumatologists.[144] Ten percent of physicians had high FABs and they were more likely to recommend bed rest and time away from work. Despite those changes in behaviors, there was no association between patient outcomes and physician FABs. In another study involving physicians, Sieben found no correlation between physician attitudes and beliefs and their self-reported treatment choices or patient outcomes.[148]

Literature Gaps

The current studies investigating the impact of the attitudes and beliefs of physical therapists on the outcomes of patients with LBP are conflicting and limited. Both identified studies assessed the impact of changes in attitudes and beliefs and did not consider the impact of attitudes and beliefs separate from an educational intervention.[163,164] Although several studies have shown clinician attitudes and beliefs can be changed through education,[165-168] it is likely that it would take more than just a short educational intervention to change the behavior of the physical therapists in a meaningful way.[169] The educational interventions used in the studies may also have limited effectiveness and a different educational strategy may be better at changing attitudes, , and behaviors. The skills needed to treat patients based on the BPS model are complex, and it may take years after having a change in attitudes and beliefs for a physical therapist to become adept at implementing these skills. It is also unclear if the beliefs of the physical therapist who participated in the two studies were problematic. It is possible that physical therapists' attitudes and beliefs will not impact outcomes unless they significantly deviate from the norm. With the small sample sizes utilized in these studies, it is possible that there was limited variability in the attitudes and beliefs of the participants. Attitudes and beliefs in the Beneciuk et al. study did not vary significantly and only changed minimally after the intervention.[164] The actual attitudes and beliefs scores for physical therapists participating the Overmeer et al. study were not reported, so it is unclear if the study included participants with suboptimal attitudes and beliefs.[163] The authors noted in their discussion that many of the physical therapists participating in the study already had an interest in psychologically informed

PT. This may suggest that there was minimal deviation in attitudes and beliefs among physical therapists in the study.

Based on these limitations, there is a need for studies that investigate the impact of physical therapist attitudes and beliefs on patient outcomes without a focus on interventions aimed at changing those beliefs. It is also important to have studies that include a larger sample of physical therapists and patients who have divergent attitudes and beliefs. The main purpose of this study was to determine if physical therapist attitudes and beliefs about LBP are associated with the outcomes of patients with LBP. Secondary purposes of this project will be to describe the attitudes, beliefs, and pain science knowledge of physical therapists, and to determine the factors that influence the attitudes and beliefs of physical therapists. Several studies have described the attitudes and beliefs of physical therapists about LBP; however, of the identified studies on the topic, only 3 included physical therapists from the US. [10,145,164] Several studies have also attempted to determine factors which influence the development of clinician attitudes and beliefs.[63,142,143,170-173] The results of these studies are mixed and no clear consensus on factors that influence the development of attitudes and beliefs about LBP has emerged. Factors such as gender,[171] experience treating patients with LBP,[171] profession,[170] years of school,[173] and personal history of LBP[173] have been implicated as factors that may influence the development of attitudes and beliefs about LBP. Understanding the factors that influence the development of attitudes and beliefs about LBP will be useful when designing strategies to improve those beliefs.

Summary

LBP is a common disorder that results in significant disability and financial burden globally.[73] It has been suggested that classic models of LBP, which focus solely on BPA factors, should be expanded to include psychological and social factors.[78] Patient beliefs about LBP such as FABs and PC may increase the risk of developing LBP and may impact pain intensity, disability, and prognosis. The attitudes and beliefs of clinicians about LBP appear to impact clinical behaviors, such as activity level recommendations, and they may have an impact on the outcomes of patients with LBP. The current literature investigating the impact of physical therapists attitudes and beliefs on the outcomes of patients with LBP is limited. This project expands the current body of evidence by describing the LBP-related attitudes, beliefs and knowledge of physical therapists in the US, by identifying factors that influence the development of those beliefs, and by studying the impact of physical therapist attitudes and beliefs on the outcomes of patients with LBP.

Table 1

Impact of Attitudes and Beliefs on Clinician Behaviors				
Article	**Country**	**Participants**	**Methods**	**Results**
Askew 1998[145]	USA	46 Physical Therapists	Structured qualitative interviews	The clinicians' views on the legitimacy of the patient's complaints directly influenced decision making.
Rainville 2000[54]	USA	41 Orthopedic Surgeons 41 Family Physicians	Surveys were mailed to participants. Beliefs were measured using the HC-PAIRS. Behaviors were measured using 3 patient vignettes.	Higher HC-PAIRS scores were associated with more restrictive physical activity (r= 0.30, p= 0.006) and work recommendations (r=0.49, p <0.001).
Linton 2002 [43]	Sweden	71 Physical Therapists 60 Primary Care Physicians	Clinicians participating in a free educational session were surveyed. Beliefs were measured using selected items (14) from various questionnaires and 4 items, developed by the authors were used to measure behaviors.	High FAB were associated with less optimal beliefs about taking patients out of work (RR=2.00, 90% CI=1.02-3.92), lower rates of patient education about pain (RR=1.87, 90% CI= 0.33-10.55) and activity (RR= 1.71, 90%CI= 1.19-2.45), and did not feel they could predict the chance of chronicity (RR=1.5, 90%CI= 1.00-2.27).
McIntosh 2003[152]	United Kingdom	37 Patients with LBP 15 General Practitioners	Semi-structured qualitative interviews	The type and content of advice given to patients was related to the clinician beliefs about LBP.
Daykin 2004 [47]	United Kingdom	12 Patients with CLPB 6 Physical Therapists	Semi-structured qualitative interviews	Physical therapists' beliefs were biomedically orientated and directly influenced the type of treatment and advice the clinicians provided.
Houben 2005[46]	Netherlands	297 Manual Therapists	Participants were recruited at manual therapy focused meetings. Beliefs were measured using the PABS-PT, HC-PAIRS, BBQ-HC, TSK-HC. Behaviors were measured using 3 patient vignettes and PHODA harmfulness determinations.	PABS-PT subscale scores were correlated with advice; harmfulness determinations were in the expected directions (r=0.265 to 0.396).

Houben 2005[138]	Netherlands	36 Physical Therapist Students	Students at one university were surveyed in their last year of school. Beliefs were measured using the PABS-PT, HC-PAIRS, TSK-HC, EAST and PHODA. Behaviors were measured by asking students to select examination and treatment options for patients in 3 videos.	Students with higher biomedical scores on the PABS-PT gave more restrictive advice on video 1 ($r=0.40$, $p=0.02$) and students with higher biopsychosocial scores gave less restrictive advice on video 2 ($r=0.37$, $p=0.03$). PABS-PT scores on both subscales were associated with treatment recommendations in the expected direction (for the third video).
Bishop 2005[149]	United Kingdom	453 Physical Therapists	Surveys were sent to 900 physical therapists. Beliefs and behaviors were measured using questions about 3 patient vignettes	In vignette 2 only, physical therapists who rated the chance of chronicity higher gave more restrictive work recommendations ($X^2=21.8$, $P<0.001$). Higher ratings of spinal pathology were associated with more restrictive work recommendations for all three vignettes ($X^2=13.2, 20.6, 45$, $p<0.001$).
Poiraudeau 2006[144]	France	266 Rheumatologists 440 Patients	Clinicians were surveyed at baseline. Patients were evaluated by the clinicians at baseline and by phone interview at 3 months. Data was collected from clinicians using a 5-part survey. Beliefs were measured using FABQ-HC. Behaviors were measured using questions about clinical behaviors.	Physicians with higher FABQ scores were less likely to recommend that patients maintain maximum physical activity ($p<0.001$).
Coudeyre 2006[142]	France	864 General Practitioners	Data was collected using a 5-part survey. Beliefs were measured using FABQ-HC. Behaviors were measured using questions about clinical behaviors.	Physicians with higher FABQ scores were more likely to recommend rest ($p<0.0001$), suggested lower activity levels ($p<0.001$) and prescribed more sick leave ($p<0.005$).
Bishop 2008[48]	United Kingdom	442 General Practitioners 580 Physical Therapists	A survey was mailed to 2000 physical therapists and 2000 GPs. Beliefs were measured using the PABS-PT. Behaviors were measured using patient a vignette.	Most clinicians provided advice in-line with current guidelines. Participants who had less than optimal beliefs were 33% more likely to provide work advice ($p<0.001$), 11.8% more likely to provide activity advice, and 1.6% more likely to provide bed rest advice which

				was in-line with guidelines. The association between activity advice and bed rest was not examined statistically due to the small number of respondents who provided advice that was not in-line with guidelines.
Watson 2008[151]	England	83 General Practitioners	GPs were surveyed and practice behaviors were assessed. Beliefs were measured using the PABS-PT. Behaviors were measured by monitoring the “sickness certifications” (excuses for work greater than 2 days) prescribed by the provider.	There was no correlation between PABS-PT biomedical scores (p= 0.067) and psychosocial scores (p= 0.048).
Laekeman 2008[150]	Germany	280 Physical Therapists	Surveys were sent to 424 physical therapists. Beliefs were measured using PABS-PT and TSK. Behaviors were measured using patient vignettes.	PABS-PT scores were correlated with activity recommendations (r=0.46, p=.001, r=0.38, p=0.001) and work recommendations (r=0.46, p=0.001, r=0.37, p=0.001) in the expected direction.
Sieben 2009[148]	Netherlands	42 General Practitioners 222 Patients	Questionnaires were given to patients at baseline, 3 months, 6 months, and 12 months. Their GPS were surveyed at baseline. Beliefs were measured using the HC-PAIRS, TSK-HC, and PHODA. Behaviors were measured using patient vignettes.	Less optimal beliefs were associated with more severe pathology judgments (r=0.43, 0.59, p<0.001), restrictive activity recommendations (r=0.37, p<0.05), and harmful opinions about movement (r=0.36, p<0.05, r= 0.45, p<.0.01) that were reported by the clinicians. There was no correlation between beliefs and actual behaviors (measured based on patient questionnaires).
Fullen 2011[63]	Ireland	432 General Practitioners	Surveys were sent to 750 GPs. Beliefs were measured using the PABS-PT. Behaviors were measured using patient vignettes.	PABS-PT scores were correlated with activity (r=0.41-0.17, p=0.001) and work recommendations (r=0.31-0.17, p<0.01) in the expected direction for both vignettes.
Derghazarian 2011[146]	Canada	108 Physical Therapists	Surveys were sent to a random sample of 2,428 physical therapists. Beliefs were measured by the PABS-PT and ABS-mp.	Physical therapists beliefs were correlated with judgements of spinal pathology (r=0.24,0.27, p<0.05), risk of disability

			Behaviors were measured using patient vignettes.	judgements (r=0.22, p<0.05), return to work recommendations (r=0.40-0.24, p<0.05), and return to activity recommendations (r=0.25-0.36, p<0.05).
Simmonds 2012[45]	Canada	108 Physical Therapists	Surveys were sent to 145 physical therapists. Beliefs were measured using the PABS-PT and FPQ. Behaviors were measured using patient vignettes.	Higher PABS-PT biomedical scores were correlated with a perception of greater spinal pathology (r=0.24, 0.27, P<0.05). Both biomedical and biopsychosocial PABS-PT scores were associated with activity recommendations (r=0.21, 0.24), p<0.05) in the expected direction.
Jeffrey 2012[140]	United Kingdom	11 Physical Therapists	Semi-structured qualitative interviews	The physical therapists believed that LBP has a mechanical cause and is recurring. The physical therapist beliefs about LBP and their thoughts on the patients' expectations influenced their treatment decisions.
Valjakka 2013[147]	Finland	55 Primary Care Physicians	Surveys were sent to 145 physicians. Beliefs were measured using the ABS-mp. Behaviors were measured using an open-ended question about treatment of patients with back pain.	Higher scores on the ABS-mp were associated with a greater likelihood of addressing the psychological aspects of LBP (p <0.05).
Josephson 2013[153]	Sweden	21 Physical Therapists	Focus group discussions.	Physical therapist attitudes and beliefs about low back influenced decision making and treatment was individualized based on the physical therapists' point of view.
Mackey 2014 [141]	Ireland	47 Physical Therapist Students	Surveys were sent to 102 current and recently graduated students from one university. Beliefs were measured using the PABS-PT and behaviors were measured with patient vignettes.	PABS-PT scores were not associated with vignette responses.
Epstein-Sher 2016[143]	Israel	38 General Practitioners	Surveys were obtained from MDs attending Family Medicine courses. Beliefs were measured using the HC-PAIRS. Behaviors	HC-PAIRS scores were not associated with guideline knowledge or readiness to implement the guidelines.

			were measured using questions about current guidelines.	
Nolan 2018[139]	Various	311 Physical Therapists 160 Manual Handling Advisors	Surveys were sent electronically. Beliefs were measured using the Back-PAQ. Behaviors were measured using pictures of lifting posture.	Participants who recommended lifting with a straight spinal posture scored higher on the Back-PAQ (20.1 points, p<0.001).

HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-PT-Pain Attitudes and Beliefs Scale for Physiotherapists, BBQ_HC-Back Pain Beliefs Questionnaire, TSK-HC-Tampa Scale of Kinesiophobia, RR-Relative Risk, PHODA-Photograph Series of Daily Activities, EAST-Extrinsic Affective Simon Task, PABS-Pain Attitudes and Beliefs Scale Questionnaire, ABS-mp- Attitudes to Back Pain Scale for musculoskeletal practitioners, FPQ-Fear of Pain Questionnaire.

Table 2

Impact of Attitudes and Beliefs on Patient Beliefs				
Article	**Country**	**Participants**	**Methods**	**Results**
Daykin 2004 [47]	United Kingdom	12 Patients with LPB 6 Physical Therapists	Semi-structured qualitative interviews	If physical therapists' explanations made sense, patients changed their beliefs about back pain.
Werner 2005[154]	Norway	1502 Patients 469 Healthcare Workers (physical therapists, MDs, Chiropractors)	2717 phone calls were made to the general population of 3 counties. 1105 healthcare providers in those 3 counties were surveyed. Participants were asked to rate their agreement with 6 statements about back pain.	Chiropractors' beliefs about one question were significantly different than the other professionals; patients who were treated by chiropractors had similar beliefs (p<.0001).
Poiraudeau 2006[144]	France	266 Rheumatologists 440 Patients with LBP	Clinicians were surveyed at baseline; patients were evaluated by the clinicians at baseline and by phone interview at 3 months. Demographics, professional practice, history of LBP, and belief (FABQ-HC) data were collected for MDs. Patient outcomes included pain, Quebec Back Pain Disability Scale, Hospital Anxiety Depression questionnaire, and FABQ.	There was an association between patients' FABs and the FABs of the treating MD (p=0.0036).

Coudeyre 2007[156]	France	709 General Practitioners 2727 Patients with LBP	Surveys were sent to 1800 MDs and each responding MD was asked to enroll 1-4 consecutive patients with LBP. MDs' beliefs were measured using the FABQ-HC. Patients completed the Quebec Back Pain Disability Scale, FABQ, questions about physical demands at work, and questions about pain.	There was a correlation between physicians' beliefs and the beliefs of their patients ($r=0.10$, $p<0.0001$).
Darlow 2013[56]	New Zealand	23 Patients with LBP	Participants participated in semi-structured interviews and completed the TSK and Roland-Morris Disability Questionnaire.	Participants reported feeling uncertain about what was happening and what should be done Patient beliefs came from: 1) Observing others 2) The internet (but were cautious about the info) 3) Advice from family and friends 4) Clinicians a. Seen as providing the most reliable information b. Explanation influenced prognostic expectations c. Advice to maintain a posture or strengthen a particular muscle reinforced that the back was vulnerable d. Clinicians transfer their beliefs about pain and danger of movement to patients e. A focus on educating patients about what not to do promoted a belief that recovery was based on avoidance
Overmeer 2016[155]	Sweden	281 Patients with musculoskeletal pain	This was a secondary analysis of a study investigating the impact of an educational intervention on physical therapists.	Physical therapists' HC-PAIRS scores were not correlated with patients reports of receiving a biopsychosocial message ($p=0.062$).

			Patients were recruited by the physical therapists and filled out questionnaires at baseline, 6 weeks, and 6 months. Collected data included demographics, pain intensity, the Quebec Back Pain Disability Scale, the PCS, and the Hospital Anxiety and Depression Scale. Patients were also asked if they perceived a biopsychosocial message from the PT who treated them. HC-PAIRS data from treating physical therapists was collected.	

HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, FABQ- Fear-Avoidance Beliefs Questionnaire, PCS-Pain Catastrophizing Scale.

Table 3

Impact of Attitudes and Beliefs on Patient Outcomes				
Article	**Country**	**Participants**	**Methods**	**Results**
Poiraudeau 2006[144]	France	266 Rheumatologists 440 Patients with LBP	Clinicians were surveyed at baseline; patients were evaluated by the clinicians at baseline and by phone interview at 3 months. Demographics, professional practice, history of LBP, and belief (FABQ-HC) data was collected for MDs. Patient outcomes included pain, Quebec Back Pain Disability Scale, Hospital Anxiety Depression questionnaire, and FABQ.	MDs with high FABs were less likely to make rest and activity recommendations in-line with guidelines. MD characteristics, including FABs, did not impact patient outcomes at 3 months.
Sieben 2009[148]	Netherlands	42 General Practitioners 222 Patients	Questionnaires were given to patients at baseline, 3 months, 6 months, and 12 months. Their GPs were surveyed at baseline. Beliefs were measured using the HC-PAIRS, TSK-HC, and PHODA.	There was no correlation between beliefs and behaviors (measured based on patient questionnaires). MDs HC-PAIRS and TSK-HC were not correlated with patient outcomes at any time point. Non-significant correlations ranged from 0.00-0.07.

			Behaviors were measured using patient vignettes	
Overmeer 2011[163]	Sweden	43 Physical Therapists 229 Patients	Physical therapists either attended an 8 session course on identifying and treating psychosocial factors or were placed on a waitlist. Physical therapists' beliefs were measured using the PABS-PT, and HC-PAIRS before and after the course. Patients seen by the physical therapists prior to and following the course were surveyed at the start of care and at 6 months. Pain intensity, Quebec Back Pain Disability Scale, PCS, and HAD were measured.	Outcomes for patients treated by physical therapists attending the course were not significantly different from those who were treated by physical therapists on the waiting list (pain p=0.9, disability p=0.3). Patients with higher scores on the PCS treated by physical therapists who underwent the course had similar changes in pain (p=0.1) and disability (p=0.2) as those who were treated by waitlist therapists. Changes in clinician attitudes and beliefs towards a more psychosocial orientation was not significantly associated with improved pain or disability (p=0.2-0.9). There was a non-significant effect for disability in patients with high PCS and high HAD scores who were treated by physical therapists who had a shift towards more psychosocial orientation.
Beneciuk 2015[164]	USA	12 Physical Therapists 100 Patients	Physical therapists were randomized to receive standard training or training that included 8 hours of content on psychologically informed practice. Physical therapists were instructed to implement the strategies covered in the course. PT beliefs were measured using the HC-PAIRS and PABS-PT at baseline, after the education, and at 6 months. After completing the course, outcomes for consecutive patients were recorded for each clinician. Patient outcomes included START Back Tool, pain	Physical therapists attending the psychologically informed training had changes in their attitudes and beliefs in the expected directions: PABS-PT biomedical (-4.5), PABS-PT biopsychosocial (5.5), HC-PAIRS (-5.3). Patients treated by physical therapists who underwent the psychologically informed training had greater improvements in pain (0.8 points, p=0.046) and disability (9.0 points, p<0.001). A greater proportion of patients meeting a 30% or greater improvement in pain (48.8% vs. 21.2%) and disability (61.2% vs 33.3%) were treated by physical therapists receiving the psychologically informed education.

			intensity, and ODI at baseline and 4 weeks.	

HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-PT-Pain Attitudes and Beliefs Scale for Physiotherapists, FABQ-Fear-Avoidance Beliefs Questionnaire, TSK-HC-Tampa Scale of Kinesiophobia, PHODA- Photograph Series of Daily Activities, HAD-Hospital Anxiety and Depression Scale, PCS- Pain Catastrophizing Scale, ODI-Oswestry Low Back Index

Chapter 3: Methodology

Introduction

This chapter describes the methods utilized in this dissertation. The chapter begins with a detailed explanation of the study design and procedures. This is followed by information about the instruments that were used to collect data from physical therapists. Next, a detailed description of the outcomes data and data analysis is included. Lastly, the limitations and delimitations of the study are discussed.

Study Design

This project is a retrospective cohort design that included a survey of physical therapists and the collection of patient outcomes from Focus on Therapeutic Outcomes, Inc. (FOTO). The survey was performed electronically using the Research Electronic Data Capture (REDCap) tool. A link for the survey was generated by REDCap and provided to FOTO. The research facilitation team at FOTO delivered the link, via e-mail, to FOTO clinic contacts and FOTO users who opted to receive marketing e-mails from the company. Users were asked to distribute the link to all registered FOTO users at their clinic. Survey participants provided their name, email address, state, and clinic name, which was used by FOTO to extract patient outcome data. To encourage participation, a financial incentive in the form of a random drawing was offered to participants.

The survey was sent by FOTO on 2/6/19, 2/26/19, and 3/28/19. Data collection was stopped on 4/24/19 and the participants' names, email addresses, states, and clinic names were sent to the research facilitation team at FOTO. The outcomes data of patients with low back pain (LBP) treated by the physical therapists who completed the survey were queried for 2017 and 2018. Data from 2018 were used for the primary analysis and 2017 data were used for cross validation. Due to privacy concerns, FOTO was not able to provide data on individual patients. Instead, FOTO provided minimum, maximum, and average patient data for each participating physical therapist. The patient data provided by FOTO was keyed based on a participant identification number. This data was merged with the physical therapist survey data using the participant identification number.

Clinician Survey

The clinician survey was created in REDCap and contained four sections. The first section collected demographic and other basic information about the physical therapists. The second and third sections of the survey measured physical therapist attitudes and beliefs about LBP using the Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS)[10] and the Pain and Impairment Relationship Scale for Physiotherapists (PABS-PT).[136] The final section of the survey measured physical therapist knowledge of pain mechanisms using the Neurophysiology of Pain Questionnaire (NPQ).[174]

Section One

The survey questions utilized in this section can be found in the appendix. These include questions on age, sex, ethnicity, years of experience, entry-level and advanced education, experience treating patients with LBP, practice setting, and personal experience with LBP (see the appendix). These questions were used to describe the study sample and to provide insight into factors that are associated with the attitudes and beliefs of clinicians. Several previous studies have attempted to identify factors that are associated with, and potentially influence the development of, clinician attitudes and beliefs about LBP.[45,63,142,143,145,146,151,170-173] Alshami et al. studied the attitudes and beliefs of student physical therapists in Saudi Arabia, Australia, and Brazil using the HC-PAIRS.[173] They found no difference in HC-PAIRS scores based on sex, the year of school, personal history of LBP, or country. In a study of French general practitioners, Coudeyre et al also found no association between fear-avoidance beliefs (FABs) and clinician factors such as age, sex, years of practice, and personal history of LBP.[142] In contrast, several other studies have found a relationship between clinician attitudes and beliefs and practice setting,[146] age,[45,143] years of practice,[45,63,171,175] and sex.[171]

Section Two

Several questionnaires have been used to measure the attitudes and beliefs of clinicians about LBP.[62] The vast majority of these questionnaires are direct modifications of patient-oriented scales.[62] Commonly used patient self-report questionnaires such as the Fear-Avoidance Beliefs Questionnaire (FABQ),[46,176] the Tampa Scale of Kinesiophobia (TSK),[46,61] the Back Beliefs Questionnaire (BBQ),[46] the Attitudes to Back Pain Sale (ABS),[147] and the Pain and Impairment Relationship Scale (PAIRS)[10] have been reworded to use with clinicians. The HC-PAIRS and PABS-PT are two of the most commonly used questionnaires and are the most thoroughly tested instruments for the measurement of clinician attitudes and beliefs about LBP.[62] As a result, they were used as the primary instruments in this study.

Health Care Providers' Pain and Impairment Relationship Scale

The PAIRS was developed by Riley et al. in 1988 to measure the beliefs of patients with chronic pain about the relationship between pain and function.[177] In 1995, Rainville et al. modified the PAIRS to measure the beliefs of healthcare professionals.[10] This was done by changing the subject of each item from "I" to "Chronic back pain patients." For example, the first question on the PAIRS is "I can still be expected to fulfill work and family responsibilities despite pain" and the first question on the HC-PAIRS reads "Chronic back pain patients can still be expected to fulfill work and family responsibilities despite pain." The scale contains 15 statements about LBP and respondents rate their agreement with the statement on a 7-point scale (see the appendix). The scale is scored from 1 (Completely Disagree) to 7 (Completely Agree), with 4 being a neutral response. Items 1, 6, and 14 are reverse scored. Scores can range from 15 to 105, with higher scores indicating a stronger belief that chronic back pain should result in disability.[10]

The original study by Rainville et al. identified four factors in the HC-PAIRS. These were functional expectation (8 items), social expectation (4 items), need for a cure (3 items), and projected cognition (2 items).[10] These factors explained 29%, 10%, 9%, and 8% of the variance respectively. Houben et al. also performed a confirmatory factor analysis on the HC-PAIRS and found that the original 4-factor model described by Rainville et al. did not fit the data.[61] In a new factor analysis, Houben et al. found a 1-factor model was the best fit.[61] Both Houben et al. and Rainville et al. found that questions 10 and 13 detracted from the internal consistency of the scale and Houben et al. excluded those two items from the final version of the scale. [10,61] This left a 13-item scale that included items 1-9, 11, 12, 14, and 15, with potential scores ranging from 13-91. No other studies were identified that performed a factor analysis of the HC-PAIRS. Studies using the HC-PAIRS have consistently utilized a 1-factor model;[54,163,176,178-180] however, the use of the 15-item vs the 13-item version varies throughout the literature. Given the improved internal consistency and reduced test burden, the 13-item version of the scale was utilized in this study.

Six studies have investigated the reliability of the HC-PAIRS. The majority of these studies include physical therapists,[10,61,176,178,179] half of them used an English version of the scale,[10,54,179] and two were performed on clinicians in the United States (US).[10,54] Five of the six studies reported the internal consistency of the instrument.[10,61,176,178,179] Internal consistency represents the homogeneity of the construct measured by the items of an instrument.[181] Higher internal consistency suggests that the items of an instrument measure the same construct and lower values suggest that more than one construct is being measured. Internal consistency also provides insight into the amount of error that can be expected from an instrument. Higher internal consistency suggests that scores on an instrument include less error variance.[182] The studies investigating the HC-PAIRS used Cronbach's coefficient (Alpha, α) to measure internal consistency. Alpha ranges from 0 to 1, with higher scores indicating greater correlation between the items of the instrument.[181,182] Interpretation of alpha varies based on the length of the instrument and expectations of the tester; but, in general, authors suggest that values between 0.70 and 0.95 are acceptable.[182] Scores lower than 0.70 suggest more than one construct is being measured and scores higher than 0.95 suggest redundancy between items.[182] Internal consistency of the HC-PAIRS ranges from a low of α=0.71 for a 15-item Brazilian-Portuguese version[178] to a high of α=0.92 for the 13-item English version.[179] Only one study investigating internal consistency included US physical therapists.[10] This study, by Rainville et al., included 150 healthcare workers with 34% being physical therapists. With the removal of items 10 and 13, the alpha score of the HC-PAIRS was 0.78. This finding was replicated by Houben et al., who also found that the deletion of items 10 and 13 resulted in improved internal consistency (α=0.83). Another study that included physical therapists and osteopathic physicians from New Zealand found high internal consistency (α=0.92) for the 13-item version of the HC-PAIRS.[179]

Test-retest reliability measures the stability of an instrument with repeated administration.[181] Instruments with greater error will have more variability when repeated on subjects who are unchanged. Several statistical tests are available for assessing the reliability of an instrument. Both the Spearman rho test and the Intraclass correlation coefficient (ICC) can be used to assess the reliability of ordinal scale measures. The ICC is the preferred test because it includes both correlation and agreement.[181] Generally, when ICC scores are > 0.5, test-retest reliability is considered poor, for scores between 0.5 and 0.75, test-retest is considered moderate, for scores between 0.75 and 0.9, test-retest is considered good, and for scores above 0.9, test-retest is considered excellent.[181,183] Four studies have investigated the test-retest reliability of the HC-PAIRS.[54,176,178,179] Two of the studies included physical therapists,[178,179] one included student physical therapists,[176] and one tested reliability in physicians.[54] The study including student physical therapists was performed on a Spanish version of the HC-PAIRS and the 4-week test re-test reliability was moderate (r=0.50).[176] Magalhaes et al. found good reliability (r=0.84) for a Brazilian version of the HC-PAIRS tested over a 7 day period.[178] These results were confirmed by Moran et al., who also found good test-retest reliability (r=0.84) for an English version of the scale.[179]

Two of the studies investigating the reliability of the HC-PAIRS reported the Standard Error of Measurement (SEM), a group of tests that assess measurement error.[184] In the studies investigating the HC-PAIRS, SEM represented the standard deviation of the measurement error.[181] This was calculated using the standard deviation of the sample and a reliability coefficient, which is estimated using test-retest reliability scores from previous research ($SEM=S_x\sqrt{1-r_{xx}}$).[181] Lower values for SEM suggest less error variance and can be interpreted similarly to a standard deviation value. The SEM for the HC-PAIRS was 3.75 for a sample of 91 Osteopaths and 35 PTs from New Zealand,[179] and 4.34 for a sample of 100 Brazilian student physical therapists.

Responsiveness is the ability of an instrument to detect change.[181] Greater responsiveness suggests that an instrument has the ability to identify smaller changes in the measured construct. The responsiveness of the HC-PAIRS has been studied by investigating changes in the instrument after clinicians are exposed to an educational intervention that is expected to influence attitudes and beliefs. For example, Domenech et al. found an average drop in HC-PAIRS scores of 23 points in student physical therapists who were given training on biopsychosocial factors.[176] Several other studies found changes in HC-PAIRS scores after education[44,180,185-187] with average change scores ranging from 0.88[180] to 17.5.[187] Two studies found that the HC-PAIRS could differentiate between students who were just starting their education and those towards the end of their entry-level training.[125,188] In contrast, two studies found no changes in HC-PAIRS scores in physical therapists[189] and students[168] who participated in six hours and three hours of biopsychosocial focused training, respectively. Interpreting the results of these studies is difficult because the actual degree of change in attitudes and beliefs after an educational intervention is unknown. In general, HC-PAIRS scores change, in the expected direction, when subjects participate in education targeting attitudes and beliefs. This suggests that the HC-PAIRS can detect some degree of change in attitudes and beliefs about LBP.

The construct validity of the HC-PAIRS has been investigated by eight studies. Construct validity represents the instrument's ability to measure the paradigm it purports to measure.[181] Measuring the construct validity of an instrument is complex because it is related to an abstract concept that often has no definitive anchor.[181,190] The HC-PAIRS is designed to measure a clinician's beliefs about the connection between LBP and function. There is currently no commonly accepted reference standard for this construct. As a result, indirect methods of evaluation have been used to assess validity. These studies have utilized four main approaches.

The first approach is to compare the HC-PAIRS scores of practitioners who are expected to have different beliefs about LBP and function. If the HC-PAIRS is able to differentiate between providers who have different beliefs, it suggests that the instrument is measuring the proper construct. This approach was taken by Rainville et al., who compared the HC-PARIS scores of 150 healthcare workers (including physical therapists) with 66 functional rehabilitation experts.[10] Functional rehabilitation experts were clinicians who worked in treatment programs that focused on impairments, function, and patient attitudes and beliefs. These programs put less emphasis on symptoms and the authors expected that providers working in this setting would be less likely to see a strong connection between symptoms and function. As anticipated by the authors, clinicians with a functional rehabilitation background scored lower on the HC-PARIS (14 points, p>0.001), suggesting that the HC-PAIRS has construct validity.

The second approach to investigate the construct validity of the HC-PARIS has been to compare the activity recommendations of healthcare workers to questionnaire scores. Clinicians who score higher on the HC-PAIRS are expected to have stronger beliefs that LBP results in lower functional activity tolerance. These lower functional expectations are expected to influence the type of advice a clinician provides to patients. Three studies have investigated the relationship between HC-PAIRS scores and the recommendations provided by various healthcare workers. [54,61,176] Rainville et al. analyzed the activity recommendations of 82 physicians from the US (spine surgeons n=41, family practitioners n= 41).[54] These physicians filled out the HC-PAIRS and answered questions about work and activity recommendations based on three patient vignettes. The physicians were asked 4 questions for each vignette, including the severity of the symptoms, amount of spinal pathology, suggestions for maintaining physical activity despite the pain, and recommendations for returning to work. HC-PAIRS scores correlated with physician activity (r= 0.37, p= 0.001) and work recommendations for vignette 1 (r= 0.37, p= 0.001, r= 0.29, p=0.01) and for vignette 3 (r = 0.30, p= 0.006, r= 0.29, p=0.01). This weak correlation suggests that higher scores on the HC-PAIRS are associated with more restrictive activity and work recommendations. Houben et al. performed a similar study on physical therapists, chiropractors, manual therapists, and McKenzie therapists from the Netherlands.[61] Participants were asked to fill out the HC-PAIRS and then answer the same vignette questions used in the Rainville et al. study. HC-PAIRS scores were correlated with recommendations for all three vignettes in the expected direction (r= 0.25 to 0.45, p< 0.002). Domenech et al. used the same methodology on 174 student physical therapists and 32 general practitioners from Spain.[176] Unlike the Rainville and Houben studies, Domenech et al. did not find a correlation between HC-PAIRS scores and the activity recommendations of students or a combination of students and general practitioners. There was a moderate correlation between recommendations and HC-PAIRS when a sub-analysis of just the general practitioners was performed.

The final method used to investigate the construct validity of the HC-PARIS has been to compare HC-PARIS scores with scores on other questionnaires that purport to measure the same or similar construct. If the scores on these questionnaires are correlated with the HC-PAIRS, it suggests that they are measuring a similar construct (convergent validity). Five studies that compare the HC-PAIRS to other instruments were identified.[46,61,176,178,179] All of these studies found that HC-PAIRS scores were correlated with the other measures of clinician beliefs. Houben et al. compared the HC-PARIS scores of 295 Dutch physical therapists to their scores on the PABS-PT.[46] They found a moderate correlation between HC-PAIRS and the subscales of the PABS-PT in the expected directions (r= 0.517, p<0.001, r= -0.472, p<0.001). Magalhaes et al. compared the HC-PAIRS and PABS-PT scores of 100 Brazilian physical therapists.[178] Unlike the Houben study, the correlation between the two scales in the Magalhaes study was weak (r= 0.19, p= 0.055, r= -0.28, p= 0.005). Two studies compared HC-PAIRS scores to scores on the FABQ. One study included student physical therapists and general practitioners from Spain[176] and the other included physical therapists and osteopathic physicians from New Zealand.[179] Convergent validity was found to be good in both studies, with correlations ranging from 0.557

to 0.70. Houben et al.[61] and Moran et al.[179] also found a moderate to strong correlation between the HC-PAIRS and the TSK (0.62-0.69).

The Pain Attitudes and Beliefs Scale for Physiotherapists

The PABS-PT was developed in 2003 by Ostelo et al.[11] The goal of the instrument was to measure the attitudes and beliefs of physical therapists about the development and maintenance of chronic LBP.[178] The scale was designed on the premise that healthcare providers have attitudes and beliefs that are aligned with a biomechanical or biopsychosocial model.[136] The intent was to develop a scale that could differentiate between providers with biomedical-oriented attitudes and beliefs and those with biopsychosocial-oriented attitudes and beliefs. The PABS-PT was created by modifying questions from patient-oriented questionnaires such as the TSK (8 items), the PCS, the BBQ (2 items) and the FABQ (2 items).[11] Additional questions that were considered relevant to the treatment of LBP were also added (19 items). These 37 items were submitted to a panel of experts who shortened the tool to 31 items. The items consist of statements such as “good posture prevents back pain” and “if back pain increases in severity, I immediately adjust the intensity of my treatment accordingly.” Respondents are asked to rate their agreement with each statement on a 6-point scale. Scores of 1-3 indicate disagreement with the statement and include, totally disagree (1), largely disagree (2), and disagree to some extent (3). Ratings 4-6 correspond with agree to some extent (4), largely agree (5), and totally agree (6).

Factor analyses were performed on the scale in several studies.[46,136,150,151,178,191,192] All of the studies found two factors (biomedical, biopsychosocial); however, there is disagreement about the items that make up each factor. In the original development study, Ostelo et al. included 14 items and 6 items in the two factors.[136] The biomedical factor (14 items) had a Cronbach's alpha of 0.84 and the biopsychosocial factor had an alpha of 0.54. In an attempt to improve the internal consistency of the second factor, Houben et al. added five additional questions to the scale.[46] They identified a 10-item biomedical factor and a 9-item biopsychosocial factor. Nine of the items included in the first factor overlapped with items in the original Ostelo factor. One of the items in the new biomedical factor was from the five items that were added by Houben et al. The biopsychosocial factor included five of the items in the original Ostelo factor, two of the five items added by Houben, and two items from the original 31 items that were not included in the Ostelo factor. The internal consistency of the new biomedical factor remained good (α=0.80) and the biopsychosocial factor's internal consistency improved to 0.68. Watson et al. performed a factor analysis of the PABS-PT in 85 British general practitioners.[151] Using the factors developed by Houben et al., Watson found an alpha of 0.781 and 0.296 for the two factors. The internal consistency of the factors improved when one item was eliminated from factor one and 4 items were removed from factor two. This resulted in a 9-item biomedical factor (α=0.790) and a 5-item biopsychosocial factor (α=0.602). Laekeman et al. translated the PABS-PT into German and performed a factor analysis based on responses from German physical therapists and student physical therapists.[150] They identified a biomedical factor with 10 items and a 4-item biopsychosocial factor. Seven of the items in the first factor aligned with the Houben version and three of the items in the second factor were also include in the Houben version. Internal consistency for the German version was found to be 0.77 and 0.58. A factor analysis on the Norwegian version of the PABS-PT identified a 13-item biomedical and a 6-item biopsychosocial factor.[191] Ten of the 13 items in factor one were included in the Houben version and all 6 of the items in factor two were contained in the Houben version. The internal consistency of factor one was good (α=0.79) and, consistent with other studies, the second factor had lower internal consistency (α=0.57).

For this study, the 19-item Houben version of the PABS-PT was utilized. This version contains a 10-item biomedical and a 9-item biopsychosocial factor. It was developed using scores from 295 physical therapists and has acceptable internal consistency for both factors. The Houben version of the PABS-PT is widely used in the literature [44,45,138,146,163-165] and has significant overlap with the other versions of the scale.

Three studies have examined the reliability of the PABS-PT and have found it to be acceptable.[150,178,192] Bowey-Morris examined the test-retest reliability of the scale in 83 general practitioners in the United Kingdom.[192] The mean difference between scores for factor one was -0.15 points and factor two was -0.35. The biomedical factor had good reliability (0.81) and the biopsychosocial factor had moderate reliability (0.65). Laekeman et al. studied the reliability of a German version of the PABS-PT in 70 general practitioners and 30 student physical therapists.[150] After five weeks, the reliability was 0.83 for the first factor and 0.70 for the second factor. Magalhaes et al. found similar results in a Portuguese version of scale, with an ICC of 0.80 for the biomedical factor and 0.70 for the biopsychosocial factor.[178] Bowey-Morris and Magalhaes et al. reported an SEM of 3.13[192] and 3.57[178] for the first factor and 1.47[192] and 3.48[178] for the second factor.

The responsiveness to change of the PABS-PT has been investigated in physical therapists and general practitioners.[44,165,192] The three identified studies found that PABS-PT scores changed in the expected direction after education. For example, two studies looked at changes in scores after physical therapists participated in a course that covered biopsychosocial topics.[44,165] Vonk et al. found that Dutch physical therapists who attended a 2-day training session had an average reduction in biomedical scores of 4.4 points and an average increase of 0.67 in biopsychosocial scores.[165] Overmeer et al. found an increase in the biopsychosocial score (2.1 points, P<0.004)) and reduction in the biomedical score (8.1, P<0.001) in 42 Swedish physical therapists who completed a course focused on psychosocial prognostic factors.[44] A third study looked at PABS-PT changes in 73 UK-based general practitioners who took a 2-hour course on the management of non-specific LBP. The study found an 8.88-point drop in the biomedical factor and a 2.44-point increase in the biopsychosocial factor.[192]

Similar to the HC-PAIRS, there is no specific anchor that can be used to determine the validity of the PABS-PT. Instead, construct validity has been tested by comparing scores from various providers, by comparing PABS-PT scores to expected clinical behaviors, and by looking for concurrent validity with other measures. [46,48,63,136,138,150,151,178] Studies have consistently found that PABS-PT scores can differentiate between clinicians with divergent attitudes and beliefs,[136] are correlated with clinical behaviors, [46,48,63,150] and have convergent validity with other measures. [46,138,150,178]

Ostelo et al. looked at the impact of various clinician characteristics on PABS-PT scores.[136] They surveyed 421 physical therapists from the Netherlands and asked them to identify their specialization and the education courses they have attended. Self-reported specialization was coded as either biomedical or biopsychosocial. Physical therapists identifying as manual therapists or McKenzie therapists were coded biomedical (n=89) and those identifying as chronic pain specialists were coded biopsychosocial (n=15). A similar approach was used to code education courses. Courses focused on manual therapy were coded biomedical (n=61), and courses focused on topics such as cognitive behavioral strategies and graded exposure were coded as biopsychosocial (n=34). Scores on the PABS-PT correlated with specialization and education in the expected direction. Physical therapists coded as biomedical specialists had statistically significant higher scores (41.2 vs. 31.9, p=0.002) on the biomedical factor and those who only took biomedically-oriented courses scored lower on the biopsychosocial scale (18.4 vs. 21.4, p=0.002).

Four studies have found a correlation between PABS-PT scores and clinical behavior.[46,48,63,150] As expected, clinicians who score higher on the biomedical factor tend to give recommendations that are more restrictive of physical activity and those who score higher on the biopsychosocial factor recommend more physical activity. This trend was seen in a study of 295 physical therapists from the Netherlands.[46] Participants were asked to give physical activity recommendations based on three patient vignettes. There were moderate to weak statistically significant correlations between PABS-PT scores and activity recommendations in the expected direction. Bishop et al. had similar results in 442 general practitioners and 580 physical therapists from the United Kingdom.[48] In this study, the authors categorized advice to restrict physical activity as divergent from guideline recommendations and advice to stay active was considered aligned with guidelines. Of the clinicians whose work recommendations deviated from the guidelines, 45% had high biomedical and low biopsychosocial scores and only

12% had low biomedical and high biopsychosocial scores. There was also a linear relationship between divergent advice and scores on the two factors, in the expected direction. Two other studies involving physical therapists from Germany[150] and general practitioners from Ireland[63] also found expected correlations between PABS-PT scores and clinical behavior.

The PABS-PT has been found to have convergent validity with the TSK, BBQ, HC-PAIRS and Photograph series of Daily Activities harmfulness ratings (PHODA).[46,138,150,178] Houben et al. published 2 studies in 2005 which examined the correlation between the PABS-PT and several other questionnaires that measure clinician attitudes and beliefs.[46,138] They found that scores on the PABS-PT correlated with the HC-PAIRS, the BBQ, PHODA, and the TSK. The TSK had the strongest correlation (0.79, p<.001, with the biomedical factor) and the weakest statistically significant correlation was between the HC-PAIRS and the biomedical factor (.35, p<.05). Other authors found that the factors of the PABS-PT correlated with the TSK (0.72, -0.54)[150] and the HC-PAIRS (0.28, -0.19).[178]

Section Three

Neurophysiology of Pain Questionnaire

Moseley developed the NPQ in 2003 to the measure the pain neurophysiology knowledge of healthcare professionals and patients.[193] The scale was initially created by selecting 30 items from examinations that were given to medical students. Eleven items were eliminated because they were either redundant (1) or not appropriate for both clinicians and patients (10). The final scale consisted of 19 questions rated as either “True”, “False,” or “Undecided.” A total score between 0-19 is calculated by summing the number of correct answers. In 2013, Catley et al. performed a Rash analysis on the scale and recommended the elimination of 7 questions.[174] This revised scale contains 12 true/false items, with scores ranging from 0 to 12.

The psychometrics of the NPQ have not been extensively studied. The original article by Mosely et al. examined the construct validity of the scale.[193] They found that professionals who completed a group education session and patients who completed a one-on-one education session scored better than their untrained counterparts ($p<0.005$). Catley et al. found that the NPQ had a person separation index of 0.84, which indicates good internal consistency. Catley et al. also found that the NPQ had good test-retest reliability in patients. A French version of the scale was found to have modest internal validity ($\alpha= 0.44$) and good reliability (0.644) in patients with chronic spine pain.[194] Meeus et al. studied the test properties of a Dutch version of the NPQ in 61 healthy individuals with chronic pain and 31 healthcare professionals (physical therapists and physicians).[195] The reliability of the Dutch version was good (ICC=0.76) and the internal consistency was acceptable ($\alpha=0.77$). Despite the paucity of studies examining the psychometric properties of the NPQ in clinicians, it has been commonly used to measure pain neurophysiology knowledge in healthcare professionals.[168,196-198] In this study, the revised NPQ was used as a secondary measure to determine the pain neurophysiology knowledge of physical therapists.

Patient Outcome Data

Patient information was obtained from the FOTO database. FOTO is an international commercial outcomes assessment system that is primarily used by physical therapists to measure the physical function of patients with musculoskeletal conditions. FOTO is used in 5,012 clinics and includes over 22,000 clinicians.[199] The database contains nearly 22 million patient assessments and 6 million completed episodes of care. FOTO has several standard measures that are body part or condition specific. These standard measures are collected from every patient who has a particular condition or affected body region. For example, every patient entered into the system with LBP will be given the "Lumbar/Low Back Pain" instrument. Every patient also fills out a basic demographic questionnaire, the FABQ-physical activity, and a measure of patient satisfaction. The database also includes several optional surveys that include the PCS, STaRT Back Screening Tool, FABQ-work, Oswestry Disability Index, and specific questions about pain. The standard orthopedic measures, including the LBP measure, are computer adaptive tests (CAT). CATs utilize an algorithm that adjusts the difficulty of the questions presented to a patient based on their performance on previous questions. If a patient scores high on a question, subsequent questions will be at a higher level. This allows the measurement of a wider range of a construct with fewer questions. As a result, CATs have fewer problems with floor and ceiling effects while minimizing the testing burden on patients.

FOTO instruments are collected utilizing a patient inquiry computer-based software that FOTO developed. FOTO recommends that patients enter demographic information and complete the appropriate standard measures for their condition at the initial encounter with their physical therapist. Patients may also complete optional measures if deemed appropriate by the physical therapist. The standard functional measures ask patients a series of questions about the amount of difficulty they have with various activities. Based on the answers provided by the patient, the patient inquiry software calculates a total functional status score that ranges from 0 (low functioning) to 100 (high functioning). Ideally, these measures are regularly repeated throughout the course of treatment and at the final visit. At the final visit, patients also complete a satisfaction survey, and information, such as the number of visits and final date of service, are entered.

Computerized Lumbar Functional Status Measure

The primary measure of patient outcomes in this study was the Computerized Lumbar Functional Status measure (CLFS) included in the FOTO database. The CLFS is designed to measure the functional status of individuals with LBP. The original, non-computerized, version of the CLFS was first described by Stratford et al.[200] The authors reviewed other questionnaires, gathered information from 63 patients via the Patient Specific Functional Scale, and interviewed six experienced physical therapists. This process identified 74 items to be considered for inclusion in the instrument. The list was reviewed for redundant items and was condensed to 25 items. The items were then administered to 96 patients and reduced to 12 items based on factors such as item means, item option endorsement frequency, and internal consistency.[200] Hart et al. took the original 25 items of the lumbar functional status measure and developed a computer adaptive version based on Item Response Theory.[201] The computer adaptive version of the lumbar functional status measure utilized an average of seven questions to reach the same accuracy as the 25-item paper version. This constituted a 72% increase in efficiency. The question stem for all items in the CLFS is, “Today, because of your back problem, do you or would you have any difficulty at all performing.” The patient is then presented with a list of activities, such as “usual work,” “lifting from the floor,” or “walking 1 mile.” Patients rate their ability to perform each activity on a 0-6 scale, with 0 meaning “unable to perform” and 6 equating to “no difficulty.”

Two studies investigating the reliability of the CLFS were identified. Both studies indicate that the CLFS is a reliable measure of physical function in patients with LBP.[200,202] Stratford et al. gave the paper version of the CLFS to 77 patients with LBP. [200] The measure was repeated 48 hours later in 28 patients resulting in an ICC of 0.88. The internal consistency was good (α=0.93) and the instrument had an SEM of 6.5%. The second study reporting on the reliability of the CLFS was performed by FOTO.[199] In this report, 262 patients with chronic musculoskeletal conditions filled out functional measures on two subsequent treatment visits. Fifty-seven of the participants filled out the CLFS and it was found to have excellent reliability (r=0.93).

Three studies investigating the validity of the CLFS were identified.[200,201,203] The largest of these was performed on 17,439 patients with LBP.[201] In this study, the CLFS’s ability to discriminate between patients with known risk factors was used to investigate the relative validity of the CLFS. As expected, older patients, patients with a history of surgery, and patients with more comorbidities scored lower on the CLFS. This relative validity was confirmed in a follow-up study of 8,198 patients with LBP. [203] In this study, CLFS scores were correlated with symptom acuity, surgical history, age, payer, and comorbidities, in the expected direction. When compared to the Oswestry Disability Index, the CLFS was a better predictor of all factors except payer. [203] The CLFS was also found to have good convergent validity (r=0.79) with the Roland-Morris Questionnaire in 77 patients, ages 18-79, who were attending physical therapy for LBP.[200]

One study investigating the responsiveness of the CLFS was identified.[204] This study included 17,439 patients with LBP from 377 clinics. Only 38% (6,607) of patients included in the study had both an intake and discharge measurement on the CLFS. Responsiveness based on a statistical approach (minimal detectable changes (MDC)) and an anchor-based approach (minimal clinically important difference (MDIC)) were reported. The MDC was calculated using the 95% confidence interval and SEM values for 10 scale ranges (0-10, 11-20, 21-30 etc.). The authors reported an overall MDC for the scale and 10 specific MDCs for the various score ranges. The MDIC was anchored using a 3-point change on a 15-point global rating of change score. MDIC values were calculated using receiver operating characteristic analysis for each quartile. The overall average MDC for the CLFS was 13.9. The highest MDC (31.5) occurred for scores falling between 0-10 and 91-100, and the lowest MDC (6.0) was for scores between 41-50. Global rating of change scores were available for 2,612 of the 17,439 patients. Eighty-three percent were categorized as improved based on a 3-point or greater change. The MDCI was ≥9, ≥5, ≥3, and ≥5 for the first through fourth quartiles respectively.

CLFS data was obtained from FOTO in two formats. The first format was an average change score for each physical therapist. This was calculated by subtracting the initial CLFS score from the discharge CLFS for each patient seen by a participating physical therapist. Patients without a discharge CLFS score were not included in the analysis. The CLFS change scores for each patient seen by a participating physical therapist were averaged by FOTO. The second format of CLFS scores obtained from FOTO were average residual scores. Residual scores were calculated based on a risk stratification model developed by FOTO. Risk stratification uses patient characteristics to equalize the risk of a poor outcome for each patient. This stratification allows for a more accurate ranking of clinicians and a more detailed assessment of other non-patient factors.[205] Risk adjustment is commonly used in the literature and has been studies by several authors.[205-210] For example, Rodeghero et al. found that patients with a high risk of a poor prognosis were older, had a longer symptom duration, more extensive surgical histories, were using medication, had lower baseline disability, and were more likely to have worker's compensation, no-fault or litigation as a payer source.[208] In 2018, Burgess et al. performed a systematic review on risk stratification models used for patient reported outcome measures.[211] Fourteen studies were identified including eight studies utilizing the FOTO database. They found that the most common variables were baseline outcomes scores, age, sex, comorbidities, symptoms duration, and surgical history. The risk stratification model developed by FOTO includes intake CLFS scores, age, gender, acuity, payer type, surgical history, exercise history, medication use, previous treatment, postoperative status, and the number of comorbidities.[212] Based on these factors, FOTO predicts an expected value for the change in CLFS score at discharge. The predicted CLFS change score is subtracted from the actual CLFS change score for each patient. A residual score of zero indicates that the patient's outcome was equal to the predicted outcome based on the risk stratification model. Values greater than zero constitute better than predicted outcomes and values less than zero indicate lower than the expected outcomes. FOTO provided average residual scores for each participating physical therapist.

Secondary Measures

Average number of visits and Fear Avoidance Beliefs Questionnaire Physical Activity subscale (FABQpa) scores were used as a secondary dependent variable. Although not reported in the literature, it is reasonable to hypothesize that the LBP-related attitudes and beliefs of a physical therapist may influence decisions regarding the number of visits utilized for an episode of care. Although not a direct measurement, number of visits provides insight into the amount of resources used for an episode of care. FOTO provided the average number of visits for each participating physical therapist.

Changes in patient fear avoidance beliefs were measured using the FABQ and were included as a secondary measure. The FABQ was developed in 1993 by Waddell et al. to measure a patient's beliefs about the impact of LBP on physical activity and work.[213] The questions were developed by Waddell et al. based on the work of Fordyce, Sandstrom and Esbjornsson. The questionnaire contains 16 statements about function and patients rate their agreement with those statements on a 7-point Likert scale. The scale ranges from 0 "Completely Disagree" to 6 "Completely Agree". Scores can range from 0-66 with higher scores indicating more fear avoidance. The FABQ has a work (FABQw) and a physical activity subscale. The FABQpa subscale is calculated by summing questions 2-5 with scores ranging from 0 to 24. The FABQw subscale is calculated by summing questions 6, 7, 9-12, and 15 with scores ranging from 0 to 42. FOTO includes FABQpa as a standard measure for all patients seen for LBP and it was used in this dissertation.

The psychometric properties of the FABQ have been extensively studies and it is commonly reported in the literature.[31,213-217] The test retest-reliability of the FABQpa ranges from 0.64 to 0.90[214-216,218] and the internal consistence ranges from 0.52 to 0.79.[214,218] The FABQpa was found to have a minimal detectable change of 8.95 and a standardized response mean of 0.82 (Cohen's d) in 123 patients with acute LBP.[214] The validity of the FABQpa has been tested by comparing the scale to other measures and assessing its association with factors such as pain and disability. Swinkels-Meewisse et al. and Ostelo et al. both found a moderate to strong correlation between FABQpa and the TSK in patient with acute LBP.[104,219] FABQpa scores are also correlated with Roland-Morris Disability Questionnaire scores,[220] pain visual analog scores, [220] ODI scores,[34,221] PCS scores,[106,222] and Short Form-36 scores.[34] The construct validity of FABQpa has also been supported by studies that found a connection between FABQ scores and the development of LBP,[27] disability, [8,97] pain intensity [8,105,106] and prognosis.[31,110,112]

Chapter 4: Results

Introduction

This chapter will describe the data analysis and report the findings of the project. It will start by describing the process used to analyze the data and then report the results. The results section will be broken up into two main sections. The first section will report the results from the physical therapist survey. It will start by discussing general information on the responses and then describe the demographics of the participating physical therapists. Next, it will report on the simple and multiple linear regressions used to find characteristics that predict the low back pain (LBP) related attitudes and beliefs of physical therapists. The next section reports on the combination of data from the physical therapist survey and patient data obtained from Focus on Therapeutic Outcomes, Inc. (FOTO). It will start by describing general information from the patient data and then discuss the demographics of the patients included in the study. Next, it will report the simple and multiple linear regression, and simple and multiple logistic regression used to find physical therapist and patient characteristics that predict patient outcomes.

Data Analysis

Data analysis was performed using Excel (Microsoft, Redmond WA) and SPSS V25 (IBM, Chicago IL). Significance levels were set at $\alpha=0.05$ for all analyses. All analysis was performed by the PhD candidate with consultation from Gary Brooks PT, DrPH and Dongliang Wang, PhD.

Data Cleaning

Physical therapist data was screened for missing values using frequency tables. Participants with missing or incomplete HC-PAIRS and/or PABS-PT data were excluded from the study. Missing data for other fields was deleted pairwise when appropriate. Variables with missing data were screened for non-random omissions using the Missing Value Module in SPSS.[223] T-tests were performed on HC-PAIRS, PABS-PT and NPQ means for subjects with and without missing data and there was no significant difference between the groups. The data was screened for outliers using a cut off of ±2.2 of the interquartile range.[224]

Patient outcome data from FOTO was sorted based on the treating physical therapists' identification (ID) number that was generated by the Research Electronic Data Capture system (REDCap) used to administer the physical therapist survey. This ID number was used by SPSS to merge the physical therapist and patient data. FOTO supplied average patient data scores for each physical therapist for 2017 and 2018. Primary analysis was performed on the 2018 data and the 2017 data was used for validation. FOTO only queried patient cases with complete data so there was no missing patient data. The patient data was screened for outliers using a cut off of ±2.2 of the interquartile range.[224] The merged data set was split into three samples for analysis. Sample 1 included data for physical therapists who had at least 5 completed patient cases for the 2018 dataset. Sample 2 and 3 included data for physical therapists with at least 10 or 20 completed cases, respectively.

Descriptive Statistics

Descriptive statistics were calculated for all patient and physical therapist demographic data. Mean dependent variable scores and NPQ scores were calculated based on physical therapist demographics. Kruskal-Wallis tests were used to assess differences in belief scores and NPQ scores based on physical therapist demographics. Mean values for all physical therapist and patient data were calculated and reported. Descriptive statistics for the patient data were calculated for all three samples (5, 10, and 20 patient cut-offs). Average CLFS change scores and average CLFS residual scores were categorized for logistics regression and reported descriptively. Average CLFS change score categories were based on the MCID (5 points) of the scale.[204] Initially, the data was placed into five categories: negative change (≥ -5 points), no change (-4 to 4 points), minimal improvement (5-9 points), moderate improvement (10-14 points) and significant improvement (≥15 points). There were no physical therapists with an average negative CLFS change and only one therapist with an average CLFS change in the no change category. As a result, the categories were compressed to minimal to no change (<10), moderate change (10-14), and significant change (≥15 points). Average CLFS residual scores were categorized as less than expected change (<0), expected change (0), or more than expected change (>0). No physical therapists had an average residual change of 0, so average CLFS residual score was dichotomized into less than expected and more than expected change.

Research Questions 1-4 (Attitudes, beliefs, and knowledge of physical therapists and associated factors.)

Simple linear regression was performed to compare physical therapist demographic information with scores on the HC-PAIRS and PABS-PT. Assumption testing for normality and variance homogeneity was performed using the Shapiro-Wilk test and Levene's test, respectively. The Shapiro-Wilk test was significant for all beliefs measures, indicating skewness. Log-transformation was performed; however, the Shapiro-Wilk test was still significant. Visually, the untransformed beliefs histograms were close to normally distributed. Simple linear regression and multiple linear regression are robust to small violations of normality. [223] Log-transformation is controversial[225] and both statistically and visually, the transformation did not improve the normality of the data. As a result, the untransformed data was used for both the simple and multiple linear regression.

Multiple linear regressions were performed on HC-PAIRS scores and PABS-PT scores. Demographic information was used as predictor variables and were initially selected based on theoretical prediction, and the results of the simple linear regression. The first step of model building was to perform an all-possible subset regression.[226,227] Predictors used in the final model development were selected from the all-possible subset regression using Akaike information criterion (AIC).[228] A final model was then built using a backwards stepwise approach. Pearson correlation was used to screen for multicollinearity in the model predictors. There were no correlations between variables greater than .70, which suggest no violation of the multicollinearity assumption. [223] Normality was tested using the Shapiro-Wilk test and visually using histograms. Q-Q plots, variance inflation factor, and P-P plots were used to test residual normality, multicollinearity, and homoscedasticity. [223]

Research Question 5 (Are physical therapists' attitudes and beliefs associated with the outcomes of patients with low back pain)

Simple linear regression using average CLFS change scores, average CLFS residual scores, and the average number of visits was performed for all three patient cut-off samples. Variable normality and variance homogeneity were tested using the Shapiro-Wilk test and Levene's test, respectively. As noted above, HC-PAIRS and PABS-PT scores were significant for the Shapiro-Wilk test, but were visually normal. Simple logistic regressions using average CLFS change scores and average CLFS residual scores was also performed. Receiver operator characteristic curves were produced for average CLFS change categories and average CLFS change residual categories for beliefs scores that were significant univariate predictors.

Multilevel multiple linear regression for average CLFS change scores, average CLFS residual scores and average number of visits was performed for all three patient cut-off samples. The regression's hierarchical structure had the number of patients seen by the therapist entered into the first block. The second block contained the potential patient and physical therapist related predictors. Potential predictors entered into the second block of the regression were initially selected based on theoretical prediction, and the results of the simple linear regression. The first step of model building was to perform an all-possible subset regression.[226,227] Predictors used in the final model development were selected from the all-possible subset regression using AIC.[228] A final model was then built using a backwards stepwise approach.

Cross validation of the final model was performed using two methods. The first approach was to rebuild the final model using the physical therapists' data from 2017. The model was considered validated if the same predictors were significant for the models created from the 2018 and the 2017 data. The second approach to cross validation was to calculate correlations between predicted values and actual values. The model created using 2018 data was used to calculate predicted values in the 2017 data. Pearson correlation was calculated and correlations of > 0.5 were considered poor-fair, scores between 0.5 and 0.75 were considered moderate, scores between 0.75 and 0.9 were considered good, and scores above 0.9 were considered excellent.[181,183] Dependent variables were assessed for normality using the Shapiro-Wilk test. The presence of a linear relationship between the independent and dependent variables was assessed using scatter plots and Pearson correlation coefficient. Independent variables without a linear relationship with the dependent variable were not included in the model. After creation of the model, residual normality, multicollinearity, and homoscedasticity were assessed using Q-Q plots, variance inflation factor, and P-P plots, respectively.

A multilevel multiple logistic regression was used to develop a predictive model for average CLFS change and average CLFS residual scores for all three cut-off samples. The regression's hierarchical structure had the number of patients seen by the therapist entered into the first block. Predictors included in model development were chosen based on theoretical prediction, and the results of the simple linear regression. A backwards stepwise approach was used to build the final model.

Provider Data Findings

The provider survey was electronically sent to Focus on Therapeutic Outcomes, Inc. (FOTO) clients on 2/6/19 with two follow-up e-mails on 2/26/19 and 3/28/19. The individuals receiving the e-mails included all FOTO clinic contacts and FOTO clients who opted to receive marketing e-mails from the company. FOTO clinical contacts are clinic administrators and includes both physical therapists and non-clinical staff. At the time of the survey request FOTO had 23,285 registered clinicians in 5,012 clinics.

At the close of data collection on 4/24/19, 199 responses were recorded. Five respondents did not proceed past the consent page of the survey and 44 completed the consent page but did not respond to any other question. Of the remaining 150 participants, five did not complete the Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS) or any items after that scale. All 145 respondents who started the HC-PAIRS, finished the scale with no missing items. The Pain Attitudes and Beliefs Scale for Physiotherapists (PABS-PT) was completed by 140 respondents and 1 subject partially completed the instrument. Data analysis was performed using the 140 respondents who completed both the HC-PAIRS and the PABS-PT questionnaires. This constitutes 70% of the initial 199 respondents and represents 0.6% of registered FOTO users.

Of the included subjects, seven had missing data on other survey items. Four respondents did not complete the Neurophysiology of Pain Questionnaire (NPQ) or the demographics sections of the survey. One subject completed all the items of the NPQ except item 6. An additional two subjects did not respond to the demographics and one participant had missing items. In total, five respondents had missing or incomplete NPQ responses (3.6%) and six had missing or incomplete demographics (4.2%). There was no statistically significant difference in mean HC-PAIRS, PABS-PT, or NPQ scores for subjects with and without missing data. Subjects with missing data were deleted listwise when appropriate.

Physical Therapist Demographics

Physical therapist demographics are reported in Table 4. Females made up 44.8% of respondents and 48% of respondents were between 25-34 years of age. White, non-Hispanics accounted for 90% of participants and nearly 40% of respondents had over 20 years of experience. The most common entry-level degree was a doctorate (45.2%), and 12.1% completed a transitional doctorate of physical therapy. Only 19 individuals were residency trained and 12 had completed a fellowship. Two participants were currently enrolled in a fellowship program and one was completing a residency. Thirty four percent were board certified through ABPTS and 12.9% were Certified Manual Therapists. Sixty eight percent of respondents reported at least a minimal change in their attitudes and beliefs about LBP over the past year. Research articles and courses were the most commonly cited factors that influenced the participants' change in beliefs. Ninety six percent of respondents reported a personal history of LBP, with 10% reporting that LBP had a significant impact on their life.

Descriptive statistics for belief scales and knowledge are reported in Table 5. HC-PAIRS scores ranged from 18 to 64 with a mean of 33.34, median of 33, and a mode of 36. PABS-BM scores ranged from 12 to 45 with a mean of 26.56, median of 25.5, and a mode of 25. The range for the PABS-BPS was 27 to 48 with a mean of 36.47, a median of 37 and mode of 34. NPQ descriptive statistics were calculated for 136 respondents. Values ranged from 2 to 12 with a mean of 9.4, median of 10 and a mode of 10. No outliers were identified for the HC-PAIRS, PABS-PT or NPQ. The Shapiro-Wilk test was significant ($p<.05$) for all belief measures suggesting a violation of normality. Histograms and Q-Q plots were inspected and a general normal trend was observed. Logarithmic transformation was performed and the Shapiro-Wilk test remained significant, and plots remained generally normal. Given the apparent normality on the histograms and Q-Q plots, the lack of improvement with transformation and the stability of simple and multiple regression with small violations of normality, transformed data was not used in the analysis.[223] Non-parametric tests were utilized for comparing mean beliefs scores by demographics.

HC-PAIRS scores were less for White Non-Hispanics when compared to participants who selected “other” for race (n=3), were lower for physical therapists who graduated with a Bachelor’s degree versus those with an entry-level Master’s or Doctorate, were less for respondents with a LBP case load of greater than 50% when compared to those with a case of less than 10%, higher in participants who were not board certified in orthopedics and higher in participants who reported having no certifications. (Table 4) PABS-BM scores were lower for physical therapists who graduated with a Doctorate when compared to those graduating with a Bachelor’s, lower for physical therapists who were board certified in orthopedics, less in respondents who completed a residency or fellowship, higher in physical therapists working in an in-patient setting, and higher in survey participants who do not strength train with free weights. Scores on the PABS-BPS scale were higher for 25-34 year olds when compared to 55-64 year olds, lower for physical therapists who graduated with a Bachelor’s degree when compared to those with entry-level Master’s or Doctorate degrees, higher in respondents who have completed a residency or fellowship, higher in physical therapists board certified in orthopedics, and higher in those with any board certification when compared to non-board certified respondents.

Table 4. Mean belief and knowledge scores by demographic categories.

			Mean Score by Group			
	N	*%*	*HC-PAIRS*	*PABS-BM*	*PABS-BPS*	*NPQ (n=136)*
All Respondents	140	100	33.34(9.4)	26.56(7.0)	36.47(4.4)	9.42(1.8)
CURRENT AGE						
18-24	1	0.7	42.00	40.00	35.00	\
25-34	48	35.8	31.25(8.9)	24.29(7.0)	38.15(3.7)[1]	9.92(1.8)[1]
35-44	31	23.1	35.06(8.5)	27.19(7.2)	36.48(4.5)	9.35(1.7)
45-54	28	20.9	31.82(10.5)	27.18(7.5)	35.57(4.9)	9.46(1.5)
55-64	24	17.9	34.79(9.8)	28.50(5.5)	34.75(3.8)[1]	8.67(1.6)[1]
65-75	2	1.5	46.00(9.9)	30.50(10.6)	30.50(3.5)	10.50(0.7)
GENDER						
Male	73	54.5	31.86(7.8)	25.79(6.3)	36.77(4.3)	9.73(1.7)
Female	60	44.8	34.55(11.0)	27.20(7.8)	36.16(4.5)	9.08(1.9)
Abstain	1	0.7	48.00	40.00	36.00	7.00
ETHNICITY/RACE						
White, Non-Hispanic	121	90.3	31.93(7.9)[1]	25.96(6.5)	36.71(4.3)	9.50(1.8)
Hispanic or Latino	3	2.2	37.67(21.1)	28.00(11.8)	36.33(4.0)	8.33(2.5)
Asian or Pacific Islander	2	1.5	50.50(10.6)	31.00(9.9)	31.00(0.0)	8.00(4.2)
Other	3	2.2	54.33(9.0)[1]	37.00(6.6)	33.33(1.5)	8.00(3.0)
Abstain	5	3.7	41.20(13.2)	31.40(12.5)	35.00(5.6)	9.60(1.5)

Years of Experience						
Less Than 4	30	22.4	34.20(11.3)	26.90(8.3)	37.47(3.7)	9.37(2.3)
5-9	25	18.7	30.32(8.3)	23.88(6.8)	37.64(4.3)	9.76(2.0)
10-14	11	8.2	35.36(8.3)	25.18(4.1)	35.27(5.4)	10.00(1.5)
15-19	15	11.2	32.93(7.6)	26.67(7.4)	37.67(4.3)	9.73(1.5)
20-24	17	12.7	35.29(10.2)	28.53(9.4)	36.53(5.0)	9.12(1.4)
25 or more	36	26.9	32.78(9.3)	27.47(5.2)	34.69(4.0)	9.06(1.6)
Entry-Level Degree						
Bachelor's	33	24.6	36.55(11.1)[1,2]	28.67(6.7)[1]	34.42(4.0)[1,2]	8.82(1.6)
Master's	37	27.6	31.49(7.0)[1]	26.62(7.1)	37.19(4.6)[1]	9.48(1.4)
Doctorate	61	45.5	31.49(8.5)[2]	24.69(6.6)[1,2]	37.25(4.2)[2]	9.89(1.8)
Other	3	2.2	51.67(10.0)	39.33(2.1)[2]	34.67(0.6)	5.67(3.5)
Post Graduate Education						
None	60	42.9	33.50(9.5)	25.53(7.0)	37.27(4.4)	9.75(1.7)
tDPT	17	12.1	32.88(9.9)	25.35(7.9)	37.00(4.5)	9.20(1.5)
PhD	1	0.7	53.00	38.00	33.00	11.00
DsC	1	0.7	30.00	21.00	42.00	10.00
Residency	19	13.6	30.00(6.0)	23.47(6.0)[1]	38.95(3.8)[1]	10.11(1.9)
Fellowship	12	8.6	29.25(5.7)	21.58(5.2)[2]	38.83(2.9)[2]	10.42(1.0)
Other	17	12.1	35.82(11.4)	27.47(6.8)	35.53(4.5)	9.41(1.6)
Certifications						
None	78	55.7	35.74(10.9)[2]	27.73(7.8)	35.26(4.4)[1]	8.83(1.9)
Board Certified in Orthopedics	41	29.3	29.61(6.3)[1]	23.12(4.6)[1]	38.39(4.4)[2]	10.15(1.5)[2]
Board Certified in Sports	2	1.4	35.50(0.7)	22.00(2.8)	42.50(0.7)	10.50(0.7)
Board Certified in Geriatrics	0	0				
Board Certified in Neurology	1	0.7	39.00	28.00	36.00	10.00
Certified Manual Therapist	18	12.9	33.06(9.0)	27.00(7.6)	36.33(3.9)	9.94(1.8)

Other Certification	20	14.3	32.24(7.3)	28.81(5.8)[2]	35.52(2.8)	9.05(1.6)
PRACTICE SETTING						
Private practice outpatient orthopedics	75	53.6	32.32(8.6)	25.53(6.8)	36.84(4.3)	9.67(1.7)
Hospital-based outpatient orthopedics	43	30.7	33.53(9.1)	27.56(7.0)	35.47(4.8)	9.19(1.6)
Rehab-based outpatient orthopedics	4	2.9	28.00(9.4)	22.75(5.9)	39.50(3.9)	9.50(1.3)
Other outpatient setting	12	8.6	39.33(13.8)	29.50(7.5)	36.33(1.8)	8.67(3.1)
Inpatient setting	6	4.3	34.83(5.6)	31.83(5.4)[1]	33.67(2.9)	9.17(2.1)
Other setting	4	2.9	42.75(5.6)	35.50(5.5)	35.75(2.9)	9.50(1.3)
Changes in LBP beliefs in the last year						
No Change	43	31.9	34.05(8.5)	27.05(6.7)	35.86(5.0)	9.48(1.8)
Minimal Change	66	48.9	32.97(9.0)	25.85(7.5)	36.91(4.3)	9.27(1.9)
Significant Change	26	19.3	32.04(12)	27.04(7.0)	36.85(4.0)	9.73(1.7)
LBP Case Load						
Less than 10%	8	6.0	40.63(8.1)[1]	30.50(5.5)	35.12(3.2)	8.50(1.6)
10-24%	40	29.9	33.98(9.5)	26.43(7.2)	36.45(4.1)	9.28(2.2)
25-50%	70	52.2	32.63(9.3)	26.14(7.4)	36.70(4.6)	9.67(1.6)
Greater than 50%	16	11.9	29.94(9.6)[1]	26.50(6.0)	36.25(4.9)	9.13(1.5)
Personal History of LBP						
No history of LBP	5	3.7	40.40(11.8)	28.40(10.6)	36.20(3.4)	8.00(4.4)
History of LBP	129	96.3	32.91(9.3)	26.46(7.0)	36.49(4.4)	9.47(1.7)
Impact of LBP on the physical therapist's life (N=129)						
None	40	31.0	29.57(6.9)	24.38(6.5)	37.72(4.3)	8.43(3.8)
Minimal	76	58.9	33.89(9.2)	27.22(7.1)	36.08(4.4)	9.38(1.5)
Significant	13	10.1	37.38(13.2)	28.38(6.7)	35.08(4.0)	9.61(1.9)

Exercise Frequency						
None	4	3.0	35.50(2.4)	30.00(1.8)	34.00(2.1)	8.00(1.6)
1 time a week	7	5.2	30.29(9.8)	28.14(6.4)	36.57(5.2)	9.78(1.7)
2 times a week	23	17.2	33.91(12.5)	27.30(7.7)	36.70(4.0)	9.93(1.7)
3 times a week	30	22.4	32.67(9.3)	26.77(6.3)	37.13(3.8)	9.23(1.9)[1]
4 times a week	30	22.4	33.93(11.0)	25.50(7.6)	36.70(5.7)	9.23(1.9)
5 times a week	23	17.2	31.65(7.1)	25.35(7.8)	35.43(4.5)	8.57(2.0)
More than 5 times	17	12.7	34.53(10.1)	27.00(7.2)	36.59(3.1)	9.88(1.3)[1]
Exercise Type						
Cardiovascular exercise	114	81.4	33.17(9.3)	26.34(7.0)	36.47(4.5)	9.43(1.6)
Machine based strength training	43	30.7	33.86(9.6)	26.16(7.6)	36.60(5.0)	9.58(1.7)
Free weight strength training	72	51.4	32.85(8.9)	25.47(7.2)[1]	36.96(4.5)	9.56(1.7)
High Intensity Interval training	42	30.0	33.36(9.1)	25.45(8.0)	36.55(5.0)	9.33(2.0)

Mean scores include standard deviation in parenthesis, Superscript numbers (1:1. 2:2…) indicate a significant difference ($p \leq 0.05$). HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Table 5. Scores for beliefs and knowledge questionnaires.

	HC-PAIRS	PABS-BM	PABS-BPS	NPQ
Minimum	18	12	27	2
Maximum	64	45	48	12
Mean	33.40	26.56	36.47	9.15
Median	33.00	25.50	37.00	10
Mode	36	25	34	10

HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Simple Regression

Simple regression was performed to predict HC-PAIRS and both subscales of the PABS-PT based on physical therapist characteristics (Table 6). Entry-level degree, certification, setting, percentage of caseload made up of patients with LBP, and NPQ scores were all significant univariate predictors of HC-PAIRS scores. An entry-level Bachelor's degree (B=4.190, 95% CI[.532, 7.848],R^2= .036, p= .025), no certifications (B=3.278, 95% CI[.148, 6.409],R^2= .030, p= .040), working in orthopedic settings other than a private practice or hospital based setting (B= 4.403, 95% CI [.342, 8.465],R^2=.032, p=.034), and having a caseload made up of less than 10% patients with LBP (B= 7.723, 95% CI [1.036, 14.411]R^2=.036, p=.024) were predictive of higher HC-PAIRS scores. An entry-level Doctorate degree (B= -3.280, 95% CI[-6.421,-.140]R^2= .030, p=.041), board certification (B=-4.598, 95% CI [-8.039, -1.157],R^2=.048, p=.009) and higher NPQ scores (B=-2.046 , 95% CI [-2.861, -1.232]R^2=.156, p= <.001) were predictive of lower HC-PAIRS scores.

Age, years of experience, entry-level degree, residency training, fellowship training, certifications, practice setting, and NPQ scores were predictors of PABS-BM scores. An age of 18-34 (B= -2.992, 95% CI [-5.417,-.567], R^2=.041, p=.016), 5-9 years of experience (B=-3.259, 95% CI[-6.294,-.224], R^2=.032, p=.036), an entry-level Doctorate degree (B= -3.311, 95% CI [-5.628,-.995], R^2=.055, p=.005), residency training (B= -3.561, 95% CI[-6.994,-.128], R^2= .031, p=.042), fellowship training (B= -5.433, 95% CI[-9.589, -1.277], R^2=.048, p=.011), board certification (B=-4.469, 95% CI [-6.994,-1.943], R^2=.081, p=<.001), and higher NPQ scores (B= -1.943, 95% CI [-2.524, -1.362], R^2=.246, p=<.001) were all predictive of lower scores on the PABS-BM. An entry-level Bachelor's degree (B=2.760, 95% CI[.016,5.504], R^2=.028, p=.049), no certifications (B=3.293, 95% CI[.984,5.602],R^2= .054,p=.006), and practicing in a setting other than a private orthopedic clinic or hospital based orthopedic clinic (B=3.802, 95% CI[.785,6.819],R^2=.043,p=.014) were associated with higher PABS-BM scores.

Age, years of experience, entry-level degree, residency training, fellowship training, certifications, and NPQ scores were predictive of PABS-BPS scores. Age 18-34 (B=2.477, 95% CI[.981, 3.974],R^2=.072, p=.001), residency training (B=2.878, 95% CI[.789,4.967],R^2=.053, p=.007), fellowship training (B=2.587, 95% CI[.003, 5.172],R^2=.029, p=.050), board certification (B=3.007, 95% CI[1.434, 4.581],R^2=.094, p<.001), and higher NPQ scores (B=.895, 95% CI[.505,1.285],R^2=.133, p <.001) were associated with higher PABS-PBS scores. Age over 55 (B=-2.516, 95% CI[-4.373,-.658],R^2=.049, p=.008), over 25 years of experience (B=-2.392, 95% CI[-4.039,-.745], R^2=.056,p=.005), an entry-level Bachelor's degree (B= -2.697, 95% CI[-4.365,-.992],R^2=.067, p=.002), and no certifications (B=-2.346, 95% CI[-3.782,-.910],R^2=.070,p= .002) were associated with lower PABS-BPS scores.

Table 6. Simple linear regression of beliefs scores using physical therapist demographics as predictors.

	Simple Linear Regression											
	HC-PAIRS				*PABS-BM*				*PABS-BPS*			
	B	*F*	*p*	R^2	*B*	*F*	*p*	R^2	*B*	*F*	*p*	R^2
18-34 Years Old	-3.084	3.502	.063	.025	-2.992	5.954	**.016**	.041	2.477	10.714	**.001**	.072
35-44 Years Old	2.211	1.435	.233	.010	.817	.601	.439	.004	.016	.020	.889	.000
45-54 Years Old	-1.902	.911	.342	.007	.777	.539	.464	.004	-1.125	1.843	.177	.013
>55 Years Old	3.661	3.711	.056	.026	2.575	2.868	.093	.020	-2.516	7.169	**.008**	.049
Male	-3.092	3.865	.051	.027	-1.594	1.799	.182	.006	.618	.682	.410	.005
Female	2.112	2.480	.118	.018	1.125	.898	.345	.006	-.592	.613	.435	.004
≤4 Yrs. Experience	1.091	1.008	.317	.007	.436	.268	.605	.002	1.267	3.027	.084	.021

5-9 Yrs. Experience	-3.680	3.178	.077	.023	-3.259	4.509	**.036**	.032	1.423	2.147	.145	.015
10-14 Yrs. of Experience	2.193	2.191	.141	.016	-1.493	1.121	.292	.008	-1.301	2.052	.154	.015
15-19 Yrs. of Experience	-.459	.143	.707	.001	.123	.149	.700	.001	1.339	3.187	.076	.023
20-24 Yrs. of Experience	2.221	.973	.326	.007	2.245	1.523	.219	.011	.066	.003	.954	.000
≥25 Yrs. of Experience	-.761	.176	.676	.001	1.232	1.210	.273	.009	-2.392	8.249	**.005**	.056
Bachelor's	4.109	5.130	**.025**	.036	2.760	3.956	**.049**	.028	-2.679	9.863	**.002**	.067
Master's	-2.523	1.963	.163	.014	.088	.139	.710	.001	.976	1.331	.251	.010
Doctorate	-3.280	4.265	**.041**	.030	-3.311	7.993	**.005**	.055	1.372	3.379	.068	.024
No Post Graduate Education	-.275	.029	.865	.000	1.792	2.239	.137	.016	-1.392	3.463	.065	.024
tDPT	-.524	.215	.644	.007	-1.371	.638	.426	.005	.602	.276	.600	.002
Residency	-3.868	2.80	.097	.020	-3.561	4.221	**.042**	.031	2.878	7.426	**.007**	.053
Fellowship	-4.477	2.50	.116	.018	-5.433	6.686	**.011**	.048	2.587	3.921	**.050**	.029
Board Certification	-4.598	6.980	**.009**	.048	-4.469	12.243	**<.001**	.081	3.007	14.284	**<.001**	.094
Manual Therapy Certification	-.151	.271	.603	.002	.543	.136	.713	.001	-.167	.226	.635	.002
Board and Manual Therapy Certification	-2.844	.437	.510	.003	-4.726	2.190	.141	.016	1.70	.337	.563	.002
No Certification	3.278	6.652	**.040**	.030	3.293	7.954	**.006**	.054	-2.346	10.437	**.002**	.070
Private Ortho	-1.068	2.195	.141	.016	-2.263	3.474	.064	.025	.823	1.645	.202	.012
Hospital Ortho	.513	.300	.585	.002	1.514	1.384	.241	.010	-1.491	3.468	.065	.026
Other Ortho Settings	4.403	4.596	**.034**	.032	3.802	6.208	**.014**	.043	1.00	.508	.477	.004
LBP Case Load <10%	7.723	5.215	**.024**	.036	4.182	2.692	.103	.019	-1.428	.787	.377	.006
LBP Case Load 10-24%	.885	.250	.618	.002	-.185	.020	.889	.000	-.030	.001	.971	.000
LBP Case Load 25-50%	-1.429	.802	.372	.006	-.829	.483	.488	.003	.457	.373	.542	.003
LBP Case Load >50%	-3.845	2.380	.125	.017	-.065	.001	.973	.000	-.250	.045	.832	.000

No Beliefs Change	.991	1.126	.290	.008	.944	.540	.464	.004	-.953	2.044	.155	.015
Minimal Beliefs Change	-.706	.194	.660	.001	-1.341	1.267	.262	.009	.828	1.271	.261	.009
Sig. Beliefs Change	-1.602	.609	.436	.004	.591	.373	.542	.001	.460	.247	.620	.002
LBP Minimal Impact	1.207	1.513	.221	.011	1.458	1.760	.187	.031	-.859	1.969	.163	.014
LBP Significant Impact	4.455	2.665	.105	.019	2.015	1.123	.291	.008	-1.537	1.432	.233	.001
Exercise 1x/week or Less	-1.260	.180	.672	.001	2.454	1.232	.269	.009	-.906	.425	.516	.003
Exercise 2x/week	.682	.100	.752	.001	.894	.308	.580	.002	.268	.070	.791	.001
Exercise 3x/week	-.861	.195	.659	.001	.267	.034	.855	.000	.842	.856	.356	.006
Exercise 4x/week	.752	.149	.700	.001	-1.345	.859	.356	.006	.291	.102	.750	.001
Exercise 5x/week	-.655	.137	.712	.001	-.710	.289	.592	.002	-.765	.856	.357	.006
Cardiovascular Exercise	-.949	.260	.645	.002	-1.158	.570	.451	.004	.012	.000	.990	.000
Machine-Based Strengthen Exercise	.747	.186	.667	.001	-.569	.193	.661	.001	.192	.056	.813	.000
Free Weight Based Strengthen Exercise	-1.020	.408	.524	.003	-2.234	3.583	.025	.025	1.002	1.811	.181	.013
High Intensity Training	.248	.165	.686	.001	-1.569	2.11	.149	.015	.102	.114	.736	.001
NPQ	-2.046	24.697	**<.001**	.156	-1.943	43.804	**<.001**	.246	.895	20.568	**<.001**	.133

HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Multiple Linear Regression

HC-PAIRS

The seven significant predictors from the simple regression were entered into a best subsets regression. One hundred twenty-seven models were created and sorted by AIC. The model with the lowest AIC (585.868) excluded three predictors, an entry-level Doctoral degree, board certification, and no certifications. Backwards multiple regression was performed with the remaining 4 variables, which included an entry-level Bachelor's degree, working in orthopedic settings other than a private practice or hospital-based setting, having a caseload made up of less than 10% patients with LBP, and NPQ scores (Table 7). Variance inflation factor (VIF) scores were below 2.0 and Pearson Correlations were less than .190, which indicated that multicollinearity was not present. A model containing all 6 of the predictors significantly predicted HC-PAIRS scores ($p<.001$) with an adjusted R^2 of .189. NPQ score was the only significant coefficient in this model. After the removal of the caseload variable, the adjusted R^2 dropped to .176 and both NPQ scores ($p<.001$) and the practice-setting variable ($p= .050$) were significant predictors. The entry-level Bachelor's degree variable was then removed, leaving a two variable model that was significant ($p<.001$) and had an adjusted R^2 of .162. In this model, the NPQ coefficient had a p-value of <.001 and the practice setting variable had a p-value of .069. This left NPQ as the only significant predictor of HC-PAIRS with an adjusted R^2 of .147 and a β of -2.31, 95% CI[-2.851,-1.213].

Table 7. Multiple regression modeling to predict HC-PAIRS scores.

	HC-PAIRS Multiple Regression					
	Coefficients	*β*	*Standardized β*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model 1 C=47.574 R^2=.213 AR^2= .189 p <.001	NPQ	-1.713	-.330	-2.538	-.888	<.001
	Setting other than	3.429	.142	-.352	7.211	.075
	Entry-level Bachelor's Degree	3.225	.147	-.209	6.659	.065
	Case load of less than 10% LBP	5.521	.139	-.691	11.734	.081
	NPQ	-1.796	-346	-2.622	-.970	<.001

Model 2 C=48.625 R^2=.195 AR^2=.176 p<.001	Setting other than	3.793	.157	.004	7.582	.050
	Entry-level Bachelor's Degree	3.186	.146	-.273	7.350	.069
Model 3 C=50.828 R^2=.174 AR^2=.162 p<.001	NPQ	-1.943	-.374	-2.760	-1.125	<.001
	Setting other than	3.539	.146	-.273	7.350	.069
Model 4 C=52.325 R^2=.153 AR^2=.147 p <.001	NPQ	-2.032	-.392	-2.851	-1.213	<.001

HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, C-Constant, AR^2-Adjusted R^2

PABS-BM

The 10 significant predictors from the simple regression were entered into a best subsets regression. One thousand twenty-three models were created and sorted by AIC. The model with the lowest AIC (483.372) excluded five predictors: 5-9 years of experience, an entry-level Bachelor's degree, an entry-level Doctorate degree, residency training, and no certifications. Backwards multiple regression was performed with the remaining five variables, which included working in orthopedic settings other than a private practice or hospital-based setting, an age of 18-34, fellowship training, board certification, and NPQ scores (Table 8). VIF was below 2.0 and Pearson Correlations were less than .243, which indicated that multicollinearity was not present. A model containing all five predictors significantly predicted PABS-BM scores (p<.001) with an adjusted R^2 of .298. An age of 18-34 (p=.024) and NPQ (p<.001) were the only significant coefficients in the model. After removal of fellowship training, the adjusted R^2 dropped to .291 and an age of 18-34 (p=.027), board certification (p=.032), and NPQ scores (p<.001) were significant predictors. The final model significantly predicted PABS-BM scores (p<.001) with an R^2 of .278. The model included an age of 18-34 (β= -

2.275, 95% CI [-4.442,-.108], p=.040) board certification (β= -3.030, 95% CI[-5.374,-.686], p=.012), and NPQ scores (β=-1.63, 95% CI[-2.232,-1.047], p<.001).

Table 8. Multiple regression modeling to predict PABS-BM scores.

	PABS-BM Multiple Regression					
	Coefficients	*β*	*Standardized β*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model 1 C=42.351 R^2=.325 AR^2= .298 p <.001	Ortho setting other than private practice or hospital	2.464	-.330	-.225	5.154	.072
	Age between 18 and 34	-2.484	-.169	-4.628	-.340	.024
	Fellowship Training	-2.816	-.114	-6.482	.849	.131
	Board Certification	-2.313	-.149	-4.699	.072	.057
	NPQ	-1.534	-.394	-2.125	-.943	<.001
Model 2 C=42.715 R^2=.313 AR^2=.291 p<.001	Ortho setting other than private practice or hospital	2.523	.139	-.179	5.225	.067
	Age between 18 and 34	-2.432	-.166	-4.586	-.278	.027
	Board Certification	-2.599	-.167	-4.967	-.231	.032
	NPQ	-1.594	-.409	-2.183	-1.005	<.001
Model 3 C=43.681 R^2=.294 AR^2=.278 p<.001	Age between 18 and 34	-2.275	-.155	-4.442	-.108	.040
	Board Certification	-3.030	-.195	-5.374	-.686	.012
	NPQ	-1.639	-.421	-2.232	-1.047	<.001

PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, C-Constant, AR^2-Adjusted R^2

PABS-BPS

The nine significant predictors from the simple regression were entered into a best subsets regression. Five hundred eleven models were created and sorted by AIC. The model with the lowest AIC (363.939) excluded six predictors: an age over 55, over 25 years of experience, an entry-level Bachelor's degree, residency training, fellowship training, and no certification. Backwards multiple regression was performed with the remaining three variables (Table 9). VIF was below 2.0 and Pearson Correlations were less than .245, which indicated that multicollinearity was not present. A model containing all three predictors significantly predicted

PABS-PBS scores (p<.001) with an adjusted R^2 of .233. The model included an age of 18-34 (β=2.320, 95% CI[.949,3.690], p=.001), board certification (β=2.577, 95% CI[1.093,4.061], p= .001, and NPQ scores (β=.612, 95% CI[.237,.987], p=.002).

Table 9. Multiple regression modeling to predict PABS-BPS scores.

	PABS-BPS Multiple Regression					
	Coefficients	*β*	*Standardized β*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model 1 C=29.110 R^2=.250 AR^2=.233 p<.001	Age between 18 and 34	2.320	.257	.949	3.690	.001
	Board Certification	2.577	.269	1.093	4.061	.001
	NPQ	.612	.255	.237	.987	.002

PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, C-Constant, AR^2-Adjusted R^2

Patient Data Findings

FOTO was able to identify 105 of the 140 (75%) physical therapists who responded to the survey. These therapists had completed cases for 3,201 patients with LBP. Outlier analysis identified four physical therapists with extreme values for the number of completed cases. One therapist had 268 completed cases and three therapists had 155 completed cases in 2018. This was more than 2.2 times the interquartile range and were removed. Nine therapists had less than five completed cases and were not included in the analysis. No other outliers were present in the data.

Descriptive statistics for patient data are reported in table 10. Average patient values for a 5 patient cut-off sample, 10 patient cut-off sample, and 20 patient cut-off sample were based on data from 2,448, 2,345, and 2,016 patients respectively. The mean of the average patient age ranged from 57.3 years for a 10 patient cut-off to 56.2 years for a 5 patient cut-off. Patient age ranged from a low of less than 1 to high of 89 years. The mean average intake Computerized Lumbar Functional Status measure (CLFS) was very similar for the three cut-off points and ranged from 48.6 to 48.9. The mean average CLFS change score was 15.7 and the mean average residual score was 1.6 for all three cut-off points. Mean average Fear Avoidance Belief Scale Physical Activity subscale (FABQpa) change ranged from -6.1 to -6.8 points across samples. Physical therapist beliefs scores and NPQ varied by less than 1 point across samples. HC-PAIRS scores ranged from 31.0 to 31.8, PABS-BM scores ranged from 25.4 to 25.88, PABS-BSP ranged from 36.48 to 37.0, and NPQ scores ranged from 9.4 to 9.42 across samples.

Table 10. Patient data, physical therapist beliefs, and knowledge by sample.

Number of patients per therapist cut off	***≥5 patients*** *n=92 physical therapists 2,448 patients*		***≥10 patients*** *n=78 physical therapists 2,345 patients*		***≥20 patients*** *n=54 physical therapists 2,016 patients*	
	Mean	*Min/Max*	*Mean*	*Min/Max*	*Mean*	*Min/Max*
Number of Patients	26.6(18.7)	5/89	30.1(18.2)	10/89	37.3(17.4)	20/89
Average Patient Age (Yrs)	56.2(7.5)	41/76	57.3(6.7)	43/76	57.2(5.5)	43/70
Average Intake CLFS	48.9(4.9)	27.5/58.3	48.6(5.0)	27.5/58.3	48.9(5.0)	27.5/57.9
Average CLFS Change	15.7(5.8)	3.7/34.7	15.7(5.0)	7.5/32.2	15.7(4.7)	7.5/28.1
Average CLFS Residual Score	1.6(4.8)	-10.9/15.2	1.6(4.4)	-6.2/15.2	1.6(3.7)	-6.2/13.3
Average Intake FABQpa	47.7(9.3)	26/100	47.5(9.1)	34.2/100	47.4(8.6)	35.5/100
Average FABQpa Change	-6.1(9.6)	-41.5/21	-6.9(9.4)	-41.5/16.0	-6.8(7.3)	-26.5/7.2
Average Number of Visits	10.0(3.5)	4/23	10.3(3.3)	5/23	9.7(3.0)	5/17
PT HC-PAIRS Score	31.82(8.2)	18/56	31.0(8.0)	18/53	31.7(7.9)	18/53
PT PABS-BM Score	25.88(6.8)	13/45	25.6(6.8)	13/45	25.4(6.236)	15/45
PT PABS-BSP Scores	36.48(4.6)	27/48	37.0(4.5)	27/48	36.7(4.4)	27/44
PT NPQ Scores	9.42(2.2)	6/12	9.4(2.3)	6/12	9.4(2.2)	6/12

% of Care Provided by Other PT Providers	29.7(28.5)	0/90	29.5(29.0)	0/90	30.87(28.7)	0/90

CLFS- Computerized Lumbar Functional Scale, FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Simple Linear Regression

Average CLFS Change

Simple linear regression of CLFS change scores for the three cut-off samples are reported in Table 11. The three measures of beliefs were not significant predictors of CLFS change at the 5-patient or 20-patient cut-off, with p values ranging from .065 (HC-PAIRS) to .762 (PABS-BPS). Average FABQpa change (B=-.183, 95% CI[-.303, -.062],R^2= .095, p= .003) was the only significant predictor of CLFS change for the 5-patient cut-off sample. HC-PAIRS (B=.206, 95% CI[.069, .343],R^2= .105, p= .004), PABS-BM (B=.187, 95% CI[.024, .350],R^2= .064, p= .025), and average FABQpa change (B=-.171, 95% CI[-.092, .163],R^2= .100, p= .005) were significant predictors of CLFS change in the 10-patient cut-off sample. Average intake FABQpa (B=.147, 95% CI[-.232, -.030],R^2= .074, p= .049) and average FABQpa change (B=-.290, 95% CI[-.451, -.130],R^2= .206, p= .001) were the only two significant predictors of CLFS change for the 20-patient cut-off sample.

Table 11. Simple linear regression of average CLFS change scores.

	Simple Linear Regression *Average Computerized Lumbar Functional Status Change*											
	5 Patient Cut-off				*10 Patient Cut-off*				*20 Patient Cut-off*			
	B	*F*	*p*	R^2	*B*	*F*	*p*	R^2	*B*	*F*	*p*	R^2
HC-PAIRS	.116	2.477	.119	.027	.206	8.939	**.004**	.105	.150	3.554	.065	.064
PABS-BM	.134	2.319	.131	.025	.187	5.201	**.025**	.064	.107	1.072	.305	.020
PABS-BPS	.095	.518	.473	.006	-.109	.725	.397	.009	-.045	.092	.762	.002
NPQ	-.031	.012	.912	.000	-.244	.943	.335	.012	.125	.176	.677	.003

Number of Patients	-.023	.491	.485	.005	-.026	.654	.421	.009	-.040	1.161	.286	.022
Average Intake FABQpa	.076	1.333	.252	.015	.035	.303	.584	.004	.147	4.052	**.049**	.074
Average FABQpa Change	-.183	9.071	**.003**	.095	-.171	8.333	**.005**	.100	-.290	13.209	**.001**	.206
Average Number of Visits	.143	.658	.419	.007	.134	.584	.447	.008	-.172	.624	.433	.012
≤4 Yrs. Experience	-.095	.004	.949	.000	-1.515	1.127	.292	.015	-.538	.124	.726	.002
5-9 Yrs. Experience	1.477	1.061	.306	.012	.605	.210	.648	.003	.158	.009	.923	.000
10-14 Yrs. of Experience	-1.034	.233	.630	.003	.446	.044	.834	.001	1.110	.259	.613	.005
15-19 Yrs. of Experience	1.897	.879	.351	.010	1.555	.701	.405	.009	2.476	1.553	.218	.030
20-24 Yrs. of Experience	2.164	1.260	.265	.014	2.071	1.392	.242	.018	-.011	.000	.996	.000
≥25 Yrs. of Experience	-2.266	2.623	.109	.029	-1.432	1.192	.279	.016	-1.401	.951	.334	.018
18-34 Years Old	1.177	.910	.343	.010	-.352	.092	.763	.001	-.029	.000	.983	.000
35-44 Years Old	-.249	.028	.868	.000	.168	.014	.905	.000	.482	.106	.746	.002
45-54 Years Old	1.156	.578	.449	.007	1.075	.617	.435	.008	.297	.036	.851	.001
≥55 Years Old	-2.145	1.749	.189	.019	-.973	.386	.536	.005	-.859	.278	.600	.005
Bachelor's	-1.863	1.641	.204	.018	-1.376	1.016	.317	.014	-.543	.134	.716	.003
Master's	1.066	.567	.454	.006	1.730	1.753	.190	.023	.409	.076	.784	.001
Doctorate	1.025	.710	.402	.008	-.343	.090	.765	.001	.099	.006	.938	.000
Residency	1.229	.587	.446	.007	-.113	.006	.939	.000	1.648	1.039	.313	.020
Fellowship	2.076	.869	.354	.010	-1.979	.742	.392	.010	-1.393	.334	.566	.006
Board Certification	.037	.001	.977	.000	-.847	.513	.476	.007	-.810	.372	.544	.007
Board and Manual Therapy Certification	-1.647	.159	.691	.002	4.428	.785	.379	.010	4.386	.887	.351	.017
No Certification	-.694	.322	.572	.004	.364	.100	.753	.001	1.427	1.266	.266	.024
% of Care Provided by	-.007	.099	.754	.001	.001	.005	.945	.000	.002	.010	.922	.000

Other PT Providers												

CLFS- Computerized Lumbar Functional Scale, FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Average CLFS Residual

Simple linear regression results for CLFS residual scores are reported in Table 12. The three measures of beliefs were not significant predictors of CLFS residuals at the 5-patient and 20-patient cut-off, with p values ranging from .100 (PABS-BPS) to .810 (PABS-BPS). Average FABQpa change (B= -.131, 95% CI[.000, .294],R^2= .072, p= .011), physical therapists with ≥ 25 years of experience (B=-2.501, 95% CI[-4.777, -.225],R^2= .51, p= .032), and physical therapists who were 55 years old or older (B=-2.802, 95% CI[-5.431, -.173],R^2= .049, p= .037) were significant predictors of CLFS residual scores in the 5-patient cut-off sample. HC-PAIRS (B=.114, 95% CI[.001, .228],R^2= .050, p= .048) and average FABQpa change (B=-.124, 95% CI[-.219, -.012],R^2= .082, p= .012) were the only two predictors of CLFS residual scores in the 10-patient cut-off sample. Average FABQpa change (B= -.219, 95% CI[-.348, -.090],R^2= .185, p= .001) and 15-19 years of experience (B=3.151, 95% CI[-.029, 6.330],R^2= .072, p= .052) were significant predictors of CLFS residual scores in the 20-patient cut-off sample.

Table 12. Simple linear regression of average CLFS residual scores.

	Simple Linear Regression *Average Computerized Lumbar Functional Status Residual Score*											
	5 Patient Cut-off n=92				*10 Patient Cut-off n=78*				*20 Patient Cut-off n=54*			
	B	*F*	*p*	*R^2*	*B*	*F*	*p*	*R^2*	*B*	*F*	*p*	*R^2*
HC-PAIRS	.062	1.026	.314	.011	.114	4.031	**.048**	.050	.053	.662	.420	.013
PABS-BM	.064	.754	.388	.008	.114	2.934	.091	.037	.041	.243	.624	.005
PABS-BPS	.179	2.767	.100	.030	.025	.058	.810	.001	.092	.616	.436	.012

NPQ	.098	.180	.672	.002	-.084	.171	.680	.002	.269	1.307	.258	.025
Number of Patients	-.011	.165	.685	.002	-.012	.224	.637	.003	-.015	.252	.618	.005
Average Intake FABQpa	-.014	.061	.805	.001	-.048	.881	.351	.012	-.001	.000	.993	.000
Average FABQ pa Change	-.131	6.673	**.011**	.072	-.124	6.689	**.012**	.082	-.219	11.587	**.001**	.185
Average Number of Visits	.136	.885	.349	.010	.096	.462	.499	.006	-.139	.645	.426	.012
≤4 Yrs. Experience	.025	.000	.984	.000	-1.153	1.000	.321	.013	-.006	.000	.996	.000
5-9 Yrs. Experience	1.530	1.670	.200	.019	.728	.469	.496	.006	-.466	.123	.727	.002
10-14 Yrs. of Experience	-.344	.038	.847	.000	.670	.153	.697	.002	.946	.284	.597	.006
15-19 Yrs. of Experience	1.947	1.357	.247	.015	1.445	.932	.337	.012	3.151	3.958	**.052**	.072
20-24 Yrs. of Experience	1.764	1.220	.272	.014	1.383	.947	.334	.013	-.525	.102	.751	.002
≥25 Yrs. of Experience	-2.501	4.767	**.032**	.051	-1.510	2.057	.156	.027	-1.400	1.444	.235	.028
18-34 Years Old	1.341	1.737	.191	.019	.035	.001	.971	.000	.042	.002	.969	.000
35-44 Years Old	.188	.023	.880	.000	.288	.065	.800	.001	.412	.116	.735	.002
45-54 Years Old	1.067	.720	.399	.008	.821	.553	.459	.007	.866	.458	.501	.009
≥55 Years Old	-2.802	4.486	**.037**	.049	-1.496	1.422	.237	.019	-1.491	1.286	.262	.025
Bachelor's	-1.876	2.447	.121	.027	-1.303	1.408	.239	.019	-.937	.606	.440	.012
Master's	.999	.728	.396	.008	1.429	1.838	.179	.024	.891	.548	.463	.011
Doctorate	1.111	1.222	.272	.014	-.167	.033	.857	.000	.034	.001	.974	.000
Residency	1.757	1.831	.179	.021	.951	.642	.425	.009	1.635	1.554	.218	.030
Fellowship	2.065	1.300	.257	.015	-.998	.288	.593	.004	-.841	.182	.671	.004
Board Certification	.607	.322	.572	.004	-.192	.040	.841	.001	-.267	.061	.807	.001
Board and Manual	-1.301	.144	.705	.002	3.336	.683	.411	.009	3.286	.748	.391	.014

Therapy Certification												
No Certification	-.637	.396	.531	.004	-.230	.061	.805	.001	.731	.492	.486	.010
% of Care Provided by Other PT Providers	-.021	1.451	.232	.016	-.011	.479	.491	.006	-.006	.118	.732	.002

CLFS- Computerized Lumbar Functional Scale, FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Average Number of Visits

Simple linear regression results for the average number of visits are reported in Table 13. The three measures of beliefs were not significant predictors of number of visits at the 5-patient and 20-patient cut-off, with p values ranging from .340 (HC-PAIRS) to .921 (PABS-BPS). An age of 35-44 years old (B= 1.787, 95% CI[.027, 3.548],R^2= .044, p= .047) was the only significant predictor of the average number of visits for the 5-patient cut-off sample. HC-PAIRS (B= .096, 95% CI[.004, .188],R^2= .054, p= .041) and an age of 20-24 years old (B= 2.585, 95% CI[.300, 4.870],R^2= .064, p= .027 were significant predictors of average number of visits for the 10-patient cut-off sample. Average intake FABQpa (B= -.098, 95% CI[-.191, -.004],R^2= .079, p= .041) was the only predictor of average number of visits for the 20-patient cut-off sample.

Table 13. Simple linear regression of average number of visits.

	Simple Linear Regression *Average Number of Visits*											
	5 Patient Cut-off n=92				*10 Patient Cut-off n=78*				*20 Patient Cut-off n=54*			
	B	*F*	*p*	R^2	*B*	*F*	*p*	R^2	*B*	*F*	*p*	R^2
HC-PAIRS	.042	.919	.340	.010	.096	4.325	**.041**	.054	.046	.802	.375	.015
PABS-BM	.049	.863	.355	.009	.106	3.895	.052	.049	.016	.060	.807	001
PABS-BPS	.044	.312	.578	.003	.005	.004	.950	.000	.009	.010	.921	.000
NPQ	-.099	.358	.551	.004	-.016	.009	.924	.000	.156	.687	.411	.013
Number of Patients	-.016	.680	.412	.007	-.037	3.357	.071	.042	-.014	.354	.554	.007
Average Intake FABQpa	-.070	3.100	.082	.035	-.052	1.592	.211	.021	-.098	4.401	**.041**	.079
Average FABQpa Change	-.005	.019	.890	.000	-.007	.033	.856	.000	.044	.599	.442	.012
≤4 Yrs. Experience	-5.003	1.057	.307	.012	-4.197	.624	.432	.008	-8.825	2.446	.124	.046
5-9 Yrs. Experience	-.325	.138	.711	.002	-.649	.542	.464	.007	-.807	.585	.448	.011
10-14 Yrs. of Experience	2.457	3.728	.057	.041	-5.143	1.444	.233	.019	2.258	2.660	.109	.050
15-19 Yrs. of Experience	-.630	.262	.610	.003	.868	.486	.488	.007	-.475	.132	.718	.003
20-24 Yrs. of Experience	2.125	3.387	.069	.037	2.585	5.083	**.027**	.064	-.663	.257	.614	.005
≥25 Yrs. of Experience	-1.519	3.230	.076	.035	-1.351	2.408	.125	.032	-.832	.792	.378	.015
18-34 Years Old	-.157	.043	.835	.000	-.085	.012	.913	.000	.464	.289	.593	.006
35-44 Years Old	1.787	4.070	**.047**	.044	1.313	2.004	.161	.026	.325	.114	.737	.002
45-54 Years Old	-.222	.058	.811	.001	-.280	.093	.761	.001	-.264	.067	.797	.001
>55 Years Old	-1.533	2.455	.121	.027	-1.120	1.154	.286	.015	-.807	.585	.448	.011
Bachelor's	-1.171	1.769	.187	.020	-1.038	1.297	.258	.017	-1.408	2.221	.142	.042

Master's	.406	.224	.637	.003	.825	.879	.351	.012	-.083	.007	.932	.000
Doctorate	.556	.567	.453	.006	.103	.018	.894	.000	1.104	1.831	.182	.035
Residency	.614	.380	.539	.004	.274	.077	.782	.001	.056	.003	.958	.000
Fellowship	-.645	.216	.643	.002	-1.152	.560	.457	.008	-.816	.271	.605	.005
Board Certification	-.267	.116	.735	.001	-.777	.969	.328	.013	-.766	.796	.377	.015
Board and Manual Therapy Certification	-2.057	.677	.413	.008	-1.293	.148	.701	.002	-.769	.064	.802	.001
No Certification	.334	.203	.654	.002	.181	.055	.815	.001	.389	.219	.642	.004
% of Care Provided by Other PT Providers	.009	.483	.489	.006	.022	2.837	.096	.037	.016	1.308	.258	.025

FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire.

Multiple Linear Regression

Average CLFS Change

Results from the CLFS change multiple linear regression are reported in Table 14. Seven potential predictors of CLFS change ($p \leq .25$) were entered into a best subsets regression for the 5-patient cut-off sample. One hundred twenty-seven regressions were sorted by AIC and the model with the highest AIC (289.787) included PABS-BM, average FABQpa change, and age 55 years or older. Hierarchical multiple linear regression created a model that only included average FABQpa change. After entering number of patients in the first level, average FABQpa change (β= -.186, 95% CI[-.311, -.061], p= .004) was a significant predictor CLFS change (p=.004) with an adjusted R^2 of .079. VIF scores were below 1.1 and Pearson Correlations were less than .207, which indicated that multicollinearity was not present. Validation of the model with 2017 data also found that average FABQpa change was the only significant predictor. Pearson correlation of predicted values and actual values was .310 (p=.003) for 2018 data and .204 (p=.051) for the 2017 data.

Five potential predictors of CLFS change (p ≤.25) were entered into a best subsets regression for the 10-patient cut-off sample. Thirty-one regressions were sorted by AIC and the model with the highest AIC (231.202) included HC-PAIRS and average FABQpa change. Hierarchical multiple linear regression created a model that included both predictors. After entering number of patients in the first level, HC-PAIRS (β= .193, 95% CI[.059, .327], p= .005) and average FABQpa change (β= -.151, 95% CI[-.265, -.036], p= .010) were significant predictor CLFS change (p=.010) with an adjusted R^2 of .161. VIF scores were below 1.0 and Pearson Correlations were less than .152, which indicated that multicollinearity was not present. Validation of the model with 2017 data also found that HC-PAIRS and average FABQpa change were significant predictors of CLFS. Pearson correlation of predicted values and actual values was .440 (p=<.001) for 2018 data and .238 (p=.023) for the 2017 data.

Four potential predictors of CLFS change (p ≤.25) were entered into a best subsets regression for the 20-patient cut-off sample. Fifteen regressions were sorted by AIC and the model with the highest AIC (146.872) included HC-PAIRS and average FABQpa change. Hierarchical multiple linear regression created a model that only included average FABQpa change. After entering number of patients in the first level, average FABQpa change (β= -.284, 95% CI[-.450, -.117], p= .001) was a significant predictor CLFS change (p=.001) with an adjusted R^2 of .176. VIF scores were below 1.06 and Pearson Correlations were less than .229, which indicated that multicollinearity was not present. Validation of the model with 2017 data also found that average FABQpa change was the only significant predictor of CLFS. Pearson correlation of predicted values and actual values was .458 (p=.001) for 2018 data and .203 (p=.053) for the 2017 data.

Table 14. Hierarchical multiple linear regression of average CLFS change

	Coefficients	β	Standardized β	95% CI		P
	Computerized Lumbar Functional Scale Change Multiple Regression *5-Patient Cut-Off Sample*					
				Lower Bound	Upper Bound	
Model C=15.130 R^2=.100 AR^2= .079 P=.004	Average FABQpa Change	-.186	-.308	-.311	-.061	.004
	Computerized Lumbar Functional Scale Change Multiple Regression *10-Patient Cut-Off Sample*					
Model C=9.309 R^2=.194 AR^2=.161 P=.010	HC-PAIRS	.193	.304	.059	.327	.005
	Average FABQpa Change	-.151	-.279	-.265	-.036	.010
	Computerized Lumbar Functional Scale Change Multiple Regression *20-Patient Cut-Off Sample*					
Model C=14.249 R^2=.208 AR^2=.176 P=.001	Average FABQpa Change	-.284	-.443	-.450	-.117	.001

FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, C-Constant, AR^2-Adjusted R^2

Average CLFS Residual

Results from the CLFS residual multiple regression are reported in Table 15. Twelve potential predictors of CLFS residual scores (p ≤.25) were entered into a best subsets regression for the 5-patient cut-off sample. Four thousand ninety-five regressions were sorted by AIC and the model with the highest AIC (247.261) included PABS-BM, average FABQpa change, an age of

55 years or more, residency training, and the percentage of other physical therapy providers delivering care to the physical therapists' patients. Hierarchical multiple linear regression created a model that included average FABQpa change and an age of 55 years or greater. After entering number of patients in the first level, average FABQpa change (β= -.140, 95% CI[-.243, -.037], p= .008) and an age of 55 years or greater (β= -3.026, 95% CI[-5.726, -.325], p= .029 were significant predictor CLFS residual scores (p=.029) with an adjusted R^2 of .095. VIF scores were below 1.05 and Pearson Correlations were less than .287, which indicated that multicollinearity was not present. Validation of the model with 2017 data also found that average FABQpa change was a significant predictor; however, age of 55 years or greater was not significant (p=.311). Pearson correlation of predicted values and actual values was .339 (p=.001) for 2018 data and .164 (p=.122) for the 2017 data.

Seven potential predictors of CLFS residual scores (p ≤.25) were entered into a best subsets regression for the 10-patient cut-off sample. One hundred twenty-seven regressions were sorted by AIC and the model with the highest AIC (201.967) included PABS-BM, average FABQpa change, and an age of 55 years or greater. After entering number of patients in the first level, average FABQpa change (β= -.123, 95% CI[-.221, -.025], p= .015) was the only significant predictor CLFS residual scores (p=.015) with an adjusted R^2 of .057. VIF scores were below 1.02 and Pearson Correlations were less than .119, which indicated that multicollinearity was not present. Validation of the model with 2017 data also found that average FABQpa change was the only significant predictor of CLSF residual scores. Pearson correlation of predicted values and actual values was .288 (p=.011) for 2018 data and .188 (p=.073) for the 2017 data.

Five potential predictors of CLFS residual scores (p ≤.25) were entered into a best subsets regression for the 20-patient cut-off sample. Thirty-one regressions were sorted by AIC and the model with the highest AIC (124.931) included average FABQpa change, 15-19 years of experience and residency training. Hierarchical multiple linear regression created a model that included average FABQpa change, 15-19 years of experience and residency training. After entering number of patients in the first level, average FABQpa change (β= -.232, 95% CI[-.360, -.104], p= .001), 15-19 years of experience (β= 3.630, 95% CI[.634, 6.625], p= .038, and residency training (β= 2.485, 95% CI[.138, 4.832], p= .038) were significant predictor CLFS residual scores (p=.038) with an adjusted R^2 of .257. VIF scores were below 1.08 and Pearson Correlations were less than .265, which indicated that multicollinearity was not present. Validation of the model with 2017 data found that average FABQpa change was the only significant predictor of CLSF residual scores. Pearson correlation of predicted values and actual values was .568 (p=.011) for 2018 data and .250 (p=.018) for the 2017 data.

Table 15. Hierarchical multiple linear regression for average CLFS residual scores.

	Computerized Lumbar Functional Scale Residual Multiple Regression *5-Patient Cut-Off Sample*					
	Coefficients	*β*	*Standardized β*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model C=1.182 R^2=.127 AR^2= .095 p =.029	Average FABQpa Change	-.140	-.281	-.243	-.037	.008
	55 Years of Age or Older	-3.026	-.237	-5.726	-3.250	.029
Computerized Lumbar Functional Scale Residual Multiple Regression *10-Patient Cut-Off Sample*						
Model C=.888 R^2=.082 AR^2=.057	Average FABQpa Change	-.123	-.284	-.221	-.025	.015

P=.015						
Computerized Lumbar Functional Scale Residual Multiple Regression *20-Patient Cut-Off Sample*						
Model C= -1.816 R^2=.316 AR^2=.257 P=.038	Average FABQpa Change	-.232	-.454	-.360	-.104	.001
	15-19 Years of Experience	3.630	.310	.634	6.625	.019
	Residency Training	2.485	.262	.138	4.832	.038

FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, C-Constant, AR^2-Adjusted R^2

Average Number of Visits

Results from the average number of visits multiple regression are reported in Table 16. Six potential predictors of average number of visits (p ≤.25) were entered into a best subsets regression for the 5-patient cut-off sample. Sixty-three regressions were sorted by AIC and the model with the highest AIC (208.429) included average FABQpa intake scores, 10-14 years of experience, and 20-24 years of experience. Hierarchical multiple linear regression created a model that included 10-14 and 20-24 years of experience. After entering number of patients in the first level, 10-14 years of experience (β= 2.972, 95% CI[.403, 5.541], p= .024) and 20-24 years of experience (β= 2.379, 95% CI[.084, 4.674], p= .042 were significant predictors of average number of visits (p=.042) with an adjusted R^2 of .069. VIF scores were below 1.04 and Pearson Correlations were less than .193, which indicated that multicollinearity was not present. Validation of the model with 2017 data found that the coefficients included in the 2018 model were not significant predictors of average number of visits in the 2017 data. Pearson correlation of predicted values and actual values was .319 (p=.002) for 2018 data and .152 (p=.152) for the 2017 data.

Seven potential predictors of average number of visits ($p \leq .25$) were entered into a best subsets regression for the 10-patient cut-off sample. One hundred twenty-seven regressions were sorted by AIC and the model with the highest AIC (175.631) included HC-PAIRS, average intake FABQpa and 20-24 years of experience. Hierarchical multiple linear regression created a model that included HC-PAIRS and average intake FABQpa. After entering number of patients in the first level, HC-PAIRS (β= .130, 95% CI[.037, .223], p= .007) and intake FABQpa (β= -.093, 95% CI[-.174, -.011], p= .027 were significant predictors of average number of visits (p=.027) with an adjusted R^2 of .128. VIF scores were below 1.10 and Pearson Correlations were less than .250, which indicated that multicollinearity was not present. Validation of the model with 2017 data found that the coefficients included in the 2018 model were not significant predictors of average number of visits in the 2017 data. Pearson correlation of predicted values and actual values was .405 (p<.001) for 2018 data and .118 (p=.263) for the 2017 data.

Five potential predictors of average number of visits ($p \leq .25$) were entered into a best subsets regression for the 20-patient cut-off sample. Thirty-one regressions were sorted by AIC and the model with the highest AIC (111.863) included average intake FABQpa, less than 4 years of experience, and 10-14 years of experience. Hierarchical multiple linear regression created a model that only included average intake FABQpa scores. After entering number of patients in the first level, intake FABQpa (β= -.106, 95% CI[-.202, -.011], p= .030) was a significant predictor of average number of visits (p=.030) with an adjusted R^2 of .062. VIF scores were below 1.04 and Pearson Correlations were less than .298, which indicated that multicollinearity was not present. Validation of the model with 2017 data found that the coefficients included in the 2018 model were not significant predictors of average number of visits in the 2017 data. Pearson correlation of predicted values and actual values was .362 (p=.008) for 2018 data and .152 (p=.149) for the 2017 data.

Table 16. Hierarchical multiple linear regression of average number of visits.

	Average Number of Visits Multiple Regression *5-Patient Cut-Off Sample*					
	Coefficients	*β*	*Standardized β*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model C=10.086 R^2=.102 AR^2= .069 p =.042	10-14 Years of Experience	2.972	.246	.403	5.541	.024
	20-24 Years of Experience	2.379	.217	.084	4.674	.042
Average Number of Visits Multiple Regression *10-Patient Cut-Off Sample*						
Model C=12.058 R^2=.163 AR^2=.128 P=.060	HC-PAIRS	.130	.313	.037	.223	.007
	Average Intake FABQpa	-.093	-.257	-.174	-.011	.027
Average Number of Visits Multiple Regression *20-Patient Cut-Off Sample*						
Model C=15.685 R^2=.314 AR^2=.062 P=.030	Average FABQpa Change	-.106	-.309	-.202	-.011	.030

FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, C-Constant, AR^2-Adjusted R^2

Simple Logistic Regression

Average CLFS Change

Simple logistic regression results for CLFS change are reported in Table 17. In the 5-patient cut-off sample, 11 physical therapists had an average CLFS change score in the minimum to no change category, 36 had an average change score in the moderate change category, and 45 physical therapists were categorized into the significant change category. The only significant predictor of CLFS change for the 5-patient cut-off sample was 4-years of experience or less. This variable predicted a moderate change in CLFS scores (β= -1.642, SE=.774, Walds X^2=4.503, p= .034) with an odds ratio of .194 (95%CI[.042,.882]). In the 10-patient cut-off sample, seven physical therapists had an average CLFS change score in the minimum to no change category, 32 had an average change score in the moderate change category, and 39 physical therapists had an average CLFS change score in the significant change category. Having 4-years of experience or less was the only significant predictor for CLFS change scores for the 10-patient cut-off as well. This variable predicted a moderate change in average CLFS scores (β= -2.234, SE=.932, Walds X^2=5.741, p= .017) with an odds ratio of .107 (95%CI[.017, .666]) and it predicted a significant change in CLFS scores (β= -1.743, SE=.872, Walds X^2=4.000, p= .046) with an odds ratio of .175 995% CI[.032, .966]). In the 20-patient cut-off sample, five physical therapists had an average CLFS change score in the minimum to no change category, 19 had an average change score in the moderate change category, and 30 physical therapists had an average CLFS change score in the significant change category. The only significant predictor of CLFS change for the 20-patient cut-off sample was 4-years of experience or less. This variable predicted a moderate change in CLFS scores (β= 2.546, SE=1.180, Walds X^2=4.654, p= .031) with an odds ratio of .078 (95% CI[.008,.792]).

Table 17. Simple logistic regression of average CLFS scores.

	Simple Logistical Regression *Average Computerized Lumbar Functional Status Change* *(Minimal-No Change (<10)*, Moderate Change (10-14), Significant Change (>15)*											
	5 Patient Cut-off (n=92) *Min n=11, Mod n=36, Sig n=45*				*10 Patient Cut-off (n=78)* *Min n=7, Mod n=32, Sig n=39*				*20 Patient Cut-off (n=54)* *Min n=5, Mod n=19, Sig n=30*			
	B	*SE*	*p*	*OR*	*B*	*SE*	*p*	*OR*	*B*	*SE*	*p*	*OR*
HC-PAIRS Moderate	-.022	.044	.618	.978	-.014	.059	.816	.986	.000	.073	.995	1.000
HC-PAIRS Significant	.029	.042	.486	1.030	.063	.057	.268	1.065	.074	.070	.290	1.077
PABS-BM Moderate	.011	.055	.843	1.011	.030	.070	.665	1.031	.025	.092	.785	1.025
PABS-BM Significant	.058	.053	.277	1.060	.090	.070	.194	1.095	.070	.088	.430	1.072
PABS-BPS Moderate	.036	.075	.629	1.037	-.056	.098	.566	.945	-.016	.121	.893	.984
PABS-BPS Significant	.035	.073	.634	1.035	-.100	.097	.303	.905	-.078	.116	.503	.925
NPQ Moderate	.179	.156	.252	1.196	.299	.186	.109	1.349	.169	.215	.434	1.184
NPQ Significant	.038	.137	.779	1.039	.042	.153	.783	1.043	.082	.194	.671	1.086
Number of Patients Moderate	.018	.025	.468	1.018	-.005	.026	.863	.995	.013	.037	.715	1.014
Number of Patients Significant	.033	.024	.171	1.033	.016	.025	.511	1.017	.024	.036	.496	1.024
Average Intake FABQ Moderate	.027	.044	.541	1.027	.004	.043	.934	1.004	.044	.101	.660	1.045
Average Intake FABQ Significant	.007	.044	.866	1.007	-.018	.044	.694	.983	.061	.099	.542	1.062
Average FABQ Change Moderate	-.027	.040	.502	.973	.002	.048	.972	1.002	-.051	.085	.548	.950
Average FABQ Change Significant	-.056	.040	.162	.945	-.033	.047	.480	.967	-.115	.083	.165	.891

Average Number of Visits Moderate	-.060	.100	.546	.941	-.151	.122	.215	.860	-.218	.172	.204	.804
Average Number of Visits Significant	.001	.095	.989	1.001	-.056	.113	.621	.946	-.121	.161	.450	.886
≤4 Yrs. Experience Moderate	-1.642	.774	**.034**	.194	-2.234	.932	**.017**	.107	-2.546	1.180	**.031**	.078
≤4 Yrs. Experience Significant	-1.147	.712	.107	.318	-1.743	.872	**.046**	.175	-1.551	1.011	.125	.212
5-9 Yrs. Experience Moderate	\	\	\	\	\	\	\	\	\	\	\	\
5-9 Yrs. Experience Significant	\	\	\	\	\	\	\	\	\	\	\	\
10-14 Yrs. of Experience Moderate	-.095	1.210	.937	.909	\	\	\	\	\	\	\	\
10-14 Yrs. of Experience Significant	.025	1.173	.983	1.026	\	\	\	\	\	\	\	\
15-19 Yrs. of Experience Moderate	\	\	\	\	\	\	\	\	\	\	\	\
15-19 Yrs. of Experience Significant	\	\	\	\	\	\	\	\	\	\	\	\
20-24 Yrs. of Experience Moderate	-.531	1.276	.678	.588	-.916	1.304	.482	.400	\	\	\	\
20-24 Yrs. of Experience Significant	.665	1.127	.555	1.944	.150	1.169	.898	1.161	\	\	\	\
≥25 Yrs. of Experience Moderate	.410	.761	.590	1.507	.270	.916	.768	1.310	-.134	1.029	.897	.875
≥25 Yrs. of Experience Significant	-.838	.807	.299	.432	-.726	.948	.444	.484	-1.163	1.037	.262	.313

18-34 Years Old Moderate	-.388	.698	.578	.678	-.799	.847	.346	.450	-1.435	1.051	.172	.238
18-34 Years Old Significant	-.051	.679	.940	.950	-.671	.834	.421	.511	-.898	.990	.364	.407
35-44 Years Old Moderate	.083	.888	.926	1.086	.325	1.171	.781	1.385	\	\	\	\
35-44 Years Old Significant	.310	.861	.719	1.364	.657	1.146	.567	1.929	\	\	\	\
45-54 Years Old Moderate	\	\	\	\	\	\	\	\	\	\	\	\
45-54 Years Old Significant	\	\	\	\	\	\	\	\	\	\	\	\
>55 Years Old Moderate	-.441	.797	.581	.644	-.770	.968	.426	.463	-1.269	1.109	.253	.281
>55 Years Old Significant	-1.047	.827	.206	.351	-.940	.965	.330	.391	-1.163	1.037	.262	.313
Bachelor's Moderate	-.396	.729	.587	.673	-.651	.859	.449	.522	-.368	1.038	.723	.692
Bachelor's Significant	-1.260	.766	.100	.284	-1.569	.903	.082	.208	-1.163	1.037	.262	.312
Master's Moderate	1.204	1.117	.281	3.333	\	\	\	\	\	\	\	\
Master's Significant	1.354	1.103	.220	3.871	\	\	\	\	\	\	\	\
Doctorate Moderate	.071	.691	.918	1.074	-.413	.842	.624	.662	-.944	1.029	.359	.389
Doctorate Significant	.511	.680	.452	1.667	-.016	.833	.985	.984	-.057	.988	.954	.944
Residency Moderate	-1.012	.994	.309	.364	-1.352	1.033	.191	.259	-1.504	1.518	.322	.222
Residency Significant	.192	.869	.825	1.212	-.219	.920	.812	.804	.421	1.193	.724	1.524
Fellowship Moderate	-.201	1.214	.869	.818	-.477	1.239	.700	.621	-.754	1.345	.575	.471
Fellowship Moderate	-.393	1.212	.746	.675	-1.792	1.481	.226	.167	-1.946	1.512	.198	.143
Board Certification Moderate	1.052	.853	.218	2.864	.665	.909	.465	1.944	.087	1.024	.932	1.091

Board Certification Significant	.776	.847	.360	2.172	.182	.907	.841	1.200	-.393	.997	.693	.675
Board and Manual Therapy Certification Moderate	\	\	\	\	\	\	\	\	\	\	\	\
Board and Manual Therapy Certification Significant	-1.435	1.457	.325	.238	\	\	\	\	\	\	\	\
No Certification Moderate	-.560	.710	.431	.571	-1.041	.909	.252	.353	-.724	1.024	.480	.485
No Certification Significant	-.326	.698	.640	.722	-.533	.901	.554	.587	.087	.990	.930	1.091
% of Care Provided by Other PT Providers Moderate	-.027	.013	**.003**	.973	-.028	.015	.059	.973	-.017	.018	.324	.983
% of Care Provided by Other PT Providers Significant	-.012	.012	.331	.989	-.009	.014	.521	.991	.003	.016	.840	1.003

FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire. *Reference standard=Minimal Change, \ Contains cells with zero frequencies and could not be calculated

Average CLFS Residual

Simple logistic regression results for CLFS residual scores are reported in Table 18. In the 5-patient cut-off sample, 36 physical therapists had a CLFS residual score in the less than expected category, and 56 had residual scores in the more than expected category. In the 20-patient cut-off sample, 19 physical therapists had a CLFS residual score in the less than expected category, and 35 had residual scores in the more than expected category. There were no significant predictors of CLFS residual scores for the 5-patient cut-off sample or the 20-patient cut-off sample. In the 10-patient cut-off sample, 30 physical therapists had a CLFS residual score in the less than expected category, and 48 had residual scores in the more than expected category. HC-PAIRS was a significant predictor of CLFS residual scores (β= .067, SE=.033, Walds X^2=4.119, p= .042) at the 10-patient cut-off with an odds ratio of 1.070 (95% CI[1.002,1.141]). Receiver operating characteristic (ROC) curve for HC-PAIRS produced an area under the curve (AUC) of .620. (Table 19) Sensitivity and specificity are maximized at an HC-PAIRS cut off score of 30.50, with values of .564 and .641 respectively. (Figure 1 and Table 20)

Table 18. Simple logistic regression of average CLFS residual.

	Simple Logistical Regression *Average Computerized Lumbar Functional Status Residual Change* *(Greater Than Expected Change/*Less Than Expected Change)*											
	5 Patient Cut-off (n=92) *Less n=36, More n=56*				*10 Patient Cut-off (n=78)* *Less n=30, More n=48*				*20 Patient Cut-off* *Less n=19, More n=35*			
	B	*SE*	*p*	*OR*	*B*	*SE*	*p*	*OR*	*B*	*SE*	*p*	*OR*
HC-PAIRS	.046	.028	.102	1.047	.067	.033	**.042**	1.070	.068	.041	.098	1.070
PABS-BM	.016	.032	.632	1.016	.027	.035	.435	1.028	.009	.046	.850	1.009
PABS-BPS	.042	.047	.373	1.043	-.005	.052	.923	.995	-.007	.066	.915	.993
NPQ	.003	.098	.980	1.003	-.022	.104	.832	.978	.029	.130	.824	1.029
Number of Patients	.014	.012	.248	1.015	.016	.014	.246	1.017	.015	.018	.421	1.015
Average Intake FABQ	-.034	.026	.185	.967	-.039	.029	.177	.962	.001	.034	.968	1.001
Average FABQ Change	-.037	.025	.134	.964	-.038	.028	.173	.963	-.086	.047	.069	.917
Average Number of Visits	.013	.062	.833	1.013	-.035	.071	.623	.966	-.096	.097	.324	.908
≤4 Yrs. Experience	-.383	.520	.462	.682	-.706	.582	.225	.494	-.320	.672	.634	.726
5-9 Yrs. Experience	.960	.567	.090	2.611	.783	.585	.181	2.187	.324	.759	.669	1.383
10-14 Yrs. of Experience	.754	.847	.373	2.125	1.263	1.122	.260	3.537	.875	1.157	.449	2.400
15-19 Yrs. of Experience	.318	.742	.668	1.375	.093	.771	.904	1.098	1.133	1.136	.319	3.103
20-24 Yrs. of Experience	.000	.685	1.00	1.00	-.232	.716	.746	.793	-.661	.873	.448	.516

≥25 Yrs. of Experience	-.788	.498	.113	.455	-.434	.535	.418	.648	-.405	.638	.525	.667
18-34 Years Old	.347	.442	.432	1.415	.054	.478	.910	1.056	-.067	.596	.910	.935
35-44 Years Old	.775	.573	.177	2.170	.830	.633	.190	2.294	.799	.733	.276	2.222
45-54 Years Old	-.229	.532	.667	.795	-.402	.556	.469	.669	-.028	.705	.968	.972
>55 Years Old	-.981	.579	.090	.375	-.511	.632	.419	.600	-.728	.711	.306	.483
Bachelor's	-.526	.511	.303	.591	-.402	.556	.469	.669	-.149	.659	.821	.862
Master's	-.050	.499	.920	.951	.148	.547	.786	1.160	-.149	.659	.821	.862
Doctorate	.522	.434	.229	1.685	.174	.470	.711	1.190	.223	.574	.697	1.250
Residency	1.114	.687	.105	3.048	1.040	.700	.137	2.829	1.869	1.098	.089	6.480
Fellowship	.521	.866	.548	1.684	-.024	.945	.980	.977	.555	1.192	.642	1.742
Board Certification	.878	.487	.072	2.406	.749	.509	.141	2.115	.673	.627	.283	1.960
Board and Manual Therapy Certification	-.415	1.431	.772	.660	\	\	\	\	\	\	\	\
No Certification	-.645	.441	.144	.525	-.780	.487	.109	.458	-.539	.586	.358	.583
% of Care Provided by Other PT Providers	-.010	.008	.195	.990	-.005	.008	.520	.995	.000	.010	.981	1.000

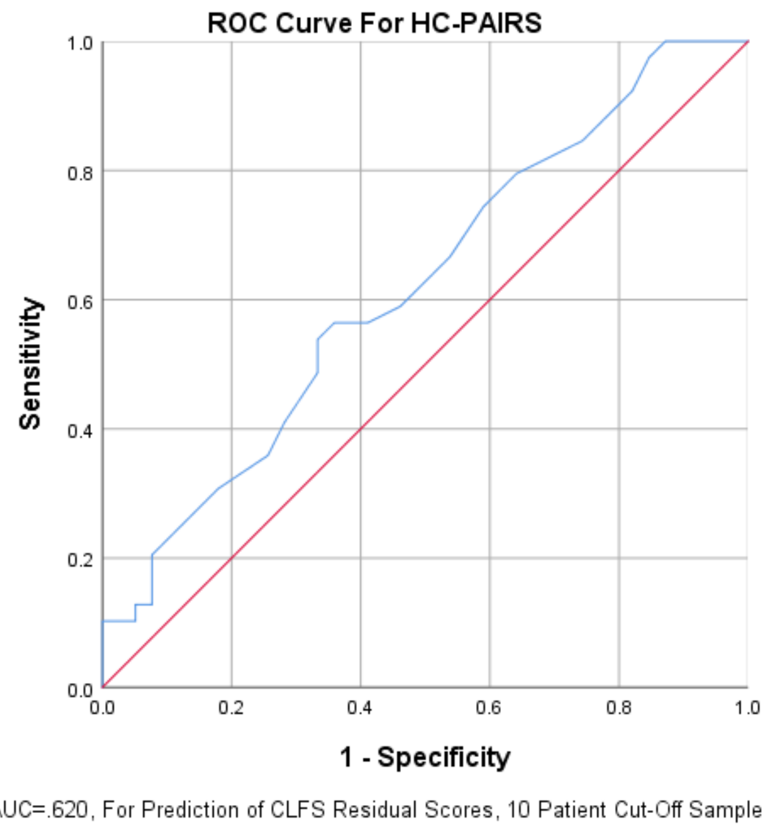
FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, PABS-BM-Pain Attitudes and Beliefs Scale for Physiotherapists biomedical subscale, PABS-BPS-Pain Attitudes and Beliefs Scale for Physiotherapists biopsychosocial subscale, NPQ- Neurophysiology of Pain Questionnaire. *Reference standard= Less than expected change, \ Contains cells with zero frequencies and could not be calculated

Table 19. Receiver operating characteristic curve for HC-PAIRS ability to predict CLFS residual.

	Discriminatory Ability HC-PAIRS *CLFS Residual 10-Patient Cut-Off Sample*						
Category	*Category Cut Off*	*N (%)*	*AUC*	*Std.Error*	*95% CI*		*P*
					Lower Bound	*Upper Bound*	
Great Than Predicted Change	CLFS Residual >0	39(50%)	.620	.063	.496	.744	.068

CLFS- Computerized Lumbar Functional Scale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale

Figure 1: Receiver operating characteristic curve for HC-PAIRS ability to predict CLFS residual



CLFS- Computerized Lumbar Functional Scale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale

Table 20. Receiver operating characteristic curve coordinates for HC-PAIRS ability to predict CLFS residual.

Coordinates of the Curve		
CLFS Residual >1, 10-Patient Cut-Off Sample		
HC-PAIRS Score	Sensitivity	1 - Specificity
17.00	1.000	1.000
19.00	1.000	.923
20.50	1.000	.872
21.50	.974	.846
22.50	.923	.821
23.50	.897	.795
24.50	.846	.744

25.50	.795	.641
26.50	.744	.590
27.50	.667	.538
28.50	.590	.462
29.50	.564	.410
30.50	.564	.359
31.50	.538	.333
32.50	.487	.333
33.50	.410	.282
35.00	.359	.256
36.50	.308	.179
37.50	.282	.154
38.50	.256	.128
39.50	.205	.077
40.50	.154	.077
41.50	.128	.077
42.50	.128	.051
43.50	.103	.051
44.50	.103	.026
45.50	.103	.000
47.00	.077	.000
49.50	.051	.000
52.00	.026	.000
54.00	.000	.000

CLFS- Computerized Lumbar Functional Scale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale

Multiple Logistic Regression

Average CLFS Change

Multiple logistic regression results for CLFS change scores are reported in table 21. The only significant model that emerged from the data was for predicting a significant improvement in scores in the 5-patient cut-off sample. When controlling the number of patients, the percentage of patients seen by other providers (β= .047, SE=.022, Walds X^2=4.880, p= .034, Odds Ratio of 1.045), and having more than 4-years of experience (β= 2.650, SE=1.200, Walds X^2=4.880, p= .027, Odds Ratio of 14.159) were significant predictors. Although a significant predictor, the 95% CI interval for the less than 4-years of experience was very wide (.953-23.165), which calls into question its predictive accuracy. The two-predictor model was significant (p=.015) and had a Nagelkerke pseudo R^2 of .257. The overall prediction success rate was 69.4% with correct prediction rates of 50% for minimal change and 84.6% for significant change. Validation of the model with 2017 data found that the coefficients included in the 2018 model were not significant predictors of average number of visits in the 2017 data. When applied to the 2017 data, the model created using the 2018 data had an overall prediction of success of 54.8%.

Table 21. Multiple logistic regression for CLFS change.

	Average CLFS Change Multiple Logistic Regression *Moderate Change 5-Patient Cut-Off Sample*					
	Coefficients	*β*	*Odds Ratio*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model C=1.547 Pseudo R^2= .090 p =.128	Less than 4 Years of Experience	1.547	4.698	.953	23.165	.057
Average CLFS Change Multiple Logistic Regression *Significant Change 5-Patient Cut-Off Sample*						
Model C=-2.934 Pseudo R^2=.257 P=.015	Less than 4 Years of Experience	2.650	14.159	1.348	48.671	.027
	Percentage of Patients Seen by Other Physical Therapy Providers	.047	1.048	1.004	1.094	.034
Average CLFS Change Multiple Logistic Regression *Moderate Change 10-Patient Cut-Off Sample*						
Model C=-1.339 Pseudo R^2=.067 P=.349	NPQ Score	.274	1.315	.906	1.909	.149
Average CLFS Change Multiple Logistic Regression *Significant Change 10-Patient Cut-Off Sample*						
Model	NPQ Score	.072	1.074	.801	1.441	.632

C=1.282 Pseudo R^2=.050 P=.192						
Average CLFS Change Multiple Logistic Regression *Moderate Change 20-Patient Cut-Off Sample*						
Model C=.252 Pseudo R^2=.051 P=.688	Age 18 to 34	.841	2.319	.306	34.496	.249
Average CLFS Change Multiple Logistic Regression *Significant Change 20-Patient Cut-Off Sample*						
Model C=.444 Pseudo R^2=.099 P=.344	Less Than 4 Years of Experience	1.649	5.200	.677	39.936	.113

CLFS- Computerized Lumbar Functional Scale, NPQ- Neurophysiology of Pain Questionnaire, C-Constant, AR^2-Adjusted R^2

Average CLFS Residual

Multiple logistic regression results for CLFS residual scores are reported in Table 22. Multiple logistic regression for CLFS residual scores produced significant models for the 5-patient and 10-patient cut off samples. When controlling for the number of patients, a four-predictor model significantly predicted CLFS residual categories (p=.002) with a Nagelkerke pseudo R^2 of .265. The model included HC-PAIRS scores (β= .093, SE= .038, Walds X^2=5.868, p= .015, Odds Ratio of 1.097), average intake FABQpa (β= -.083, SE= .036, Walds X^2=5.219, p= .022, Odds Ratio of .920), average FABQpa change (β= -.082, SE=.033, Walds X^2=6.075, p= .014, Odds Ratio of .921) and physical therapists 55 years or older (β= -1.538, SE=.729, Walds X^2=4.451, p= .035, Odds Ratio of .215). The overall prediction success rate was 70.9% with correct prediction rates of 50% for a less than expected change and 84.6% for more than predicted change. Validation of the model with 2017 data found that average FABQpa intake and change were the only significant predictors of CLFS residual categories in the 2017 data. When applied to the

2017 data, the model created using the 2018 data had an overall prediction of success of 68.2%.

A four-predictor model also significantly predicted CLFS residual scores (p=.001) for the 10-patient cut off sample with Nagelkerke pseudo R^2 of .324. This model contained three of the same predictors as the 5-patient cut-off sample, HC-PAIRS (β= .115, SE= .043, Walds X^2=7.078, p= .008, Odds Ratio of 1.122), average intake FABQpa (β= -.111, SE= .040, Walds X^2= 7.576, p= .006, Odds Ratio of .895) and average FABQpa change (β= -.101, SE= .040, Walds X^2=3.988, p= .046, Odds Ratio of .904). The final predictor was a physical therapist with 5-9 years of experience (β= 1.366, SE= .684, Walds X^2=3.988, p= .046, Odds Ratio of 3.921) and was unique to the 10-patient cut-off sample. The overall prediction success rate was 76% with correction prediction rates of 58.6% for less than expected change and 87% for more than expected change. Validation of the model with 2017 data found that average FABQpa intake and change were the only significant predictors of CLFS residual categories in the 2017 data. When applied to the 2017 data, the model created using the 2018 data had an overall prediction of success of 52.7%.

Table 22. Multiple logistic regression for average CLFS residual

	Average CLFS Residual Multiple Logistic Regression *5-Patient Cut-Off Sample*					
	Coefficients	*β*	*Odds Ratio*	*95% CI*		*P*
				Lower Bound	*Upper Bound*	
Model C=.777 Pseudo R^2= .265 p =.002	HC-PAIRS	.093	1.097	1.018	1.182	.015
	Average FABQpa Intake	-.083	.920	.857	.988	.022
	Average FABQpa Change	-.082	.921	.863	.983	.014
	55 Years of Age or Older	-1.538	.215	.051	.897	.035

Average CLFS Residual Multiple Logistic Regression *10-Patient Cut-Off Sample*						
Model C=.621 Pseudo R^2=.324 P=.001	HC-PAIRS	.115	1.122	1.031	1.222	.008
	Average FABQpa Intake	-.111	.895	.826	.968	.006
	Average FABQpa Change	-.101	.904	.836	.976	.010
	5-9 Years of Experience	1.366	3.921	1.026	14.991	.046
Average CLFS Residual Multiple Logistic Regression *20-Patient Cut-Off Sample*						
Model C=-.678 Pseudo R^2=.126 P=.080	Average FABQpa Change	-.097	.908	.825	.999	.047

FABQpa- Fear Avoidance Beliefs Questionnaire physical activity subscale, HC-PAIRS-Health Care Providers' Pain and Impairment Relationship Scale, C-Constant, AR^2-Adjusted R^2

Summary

Data analysis to predict influences on attitudes and beliefs was performed on data from 140 physical therapists. Analysis to predict factors that influenced patient outcomes was performed on three samples that were based on the number of patients seen by a therapist. The 5-patient cut-off sample included 92 physical therapists and 2,448 patients. The 10-patient cut-off sample included 78 physical therapists and 2,345 patients. The 10-patient cut-off sample included 54 physical therapists and 2,016 patients.

Simple linear regression showed that physical therapist HC-PAIRS scores were predicted by entry-level degree, board certification, practice setting, percentage of LBP-related caseload, and NPQ scores. PABS-PT scores were predicted by the physical therapists age, level of experience, entry-level degree, residency and fellowship training, board certification, practice setting, and NPQ scores. Model building using multiple linear regression led to a one-predictor model for HC-PAIRS that only included NPQ scores. Higher NPQ scores were associated with lower HC-PAIRS scores and the model explained about 15% of the variability. PABS-BM scores were predicted by a physical therapist age between 18-34, board certification, and NPQ scores. Lower PABS-BM scores were associated with having an age between 18-34, being a board certified clinical specialist, and higher NPQ scores. This model explained 28% of the variability in PABS-BM scores. PABS-BPS scores were also predicted by a physical therapist age between 18-34, board certification and NPQ scores. Higher PABS-BPS scores were associated with having an age between 18-34, being board certified and higher NPQ scores. This model predicted about 23% of the variability in PABS-BPS scores.

Simple linear regression showed that average CLFS change scores were predicted by intake FABQ scores, changes in FABQ scores, HC-PAIRS scores, and PABS-BM scores. The only predictor that was significant across all three cut-off samples was a change in FABQ scores. Average CLFS residual scores were predicted by changes in FABQ scores, HC-PAIRS scores, and level of experience. The only predictor that was significant across all three cut-off samples was a change in FABQ scores. Average number of patient visits was predicted by intake FABQ scores, HC-PAIRS scores, the physical therapists' age, and level of experience. There were no consistent univariate predictors of the number of patient visits across the three samples.

Linear predictive models were created using a backwards stepwise approach for CLFS change, CLFS residual and the average number of visits. Only two of the models included the attitudes and beliefs of physical therapists. For the 10-patient cut-off sample, greater improvement in CLFS were predicted by higher HC-PAIRS scores and reductions in FABQ scores. This model explained approximately 19% of the variability in CLFS scores. Higher average number of visits was predicted by greater HC-PAIRs scores and a greater reduction in FABQ for the 10-patient cut-off sample. This model predicted nearly 13% of the variable in the number of visits.

Simple logistic regression found that having 4 years of experience or less, and the percentage of care provided by other physical therapy providers were the only two univariate predictors of CLFS change scores at the 5-patient cut-off. Having a physical therapist with 4 years of experience or less was the only predictor of CLFS change for the 10-patient and 20-patient cut-off samples. The only univariate predictor of CLFS residual scores was HC-PAIRS scores for the 10-patient cut-off sample. An ROC curve for HC-PAIRS predicting CLFS change scores had an AUC of .620 and a cut-off to maximize specificity (.641) and sensitivity (.546) of 30.50.

Logistic predictive models were created using a backwards stepwise approach for CLFS change and CLFS residual. Physical therapist beliefs were included in the predictive model for CLFS residual for the 5-patient and 10-patient cut-off samples. A higher than predicted residual score was predicted by higher HC-PAIRS scores, lower intake FABQ scores, a reduction in FABQ scores, and being treated by a physical therapist 55 years or older for the 5-patient cut-off sample. This model explained approximately 26% of the variability in CLFS residual classification. Higher HC-PAIRS scores, lower FABQ intake scores, a reduction in FABQ scores, and 5-9 years of experience were predictive of a higher than predicted residual score for the 10-patient cut-off sample. This explained about 32% of the variability in CLFS residual classification.

Chapter 5: Discussion

Introduction

This chapter will discuss the findings of the project. It will start by covering the LBP-related attitudes and beliefs of physical therapists and the factors that influence those beliefs. Next will be a discussion of the impact of attitudes and beliefs on the outcomes of patients. This will be followed by sections on the implications of the findings, limitations and delimitations, and the author's recommendations. The chapter will end with a summary that reviews the content of the chapter.

Discussion

Physical Therapist Low Back Pain Related Attitudes and Beliefs

One of the main goals of this dissertation was to explore the low back pain (LBP) related attitudes and beliefs of physical therapists in the United State (US). In this dissertation, the average score on the Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS) was 33.34, and Pain Attitudes and Beliefs Scale for Physiotherapists (PABS-PT) average subscale scores were 26.56 for the biomedical subscale (PABS-BM) and 36.47 for the biopsychosocial subscale (PABS-BPS). Previous studies have shown that higher HC-PAIRS and PABS-BM scores, and lower PABS-BPS scores may have a negative impact on clinicians' clinical behaviors[46,48,63] and patient beliefs.[155] Although studies have looked at the influence of beliefs on clinical behaviors, there are no established cut-off points for HC-PAIRS or PABS-PT scores. In the literature, HC-PAIRS scores have been reported as high as 57.9 in 72 Irish and United Kingdom based student physical therapists [187]and as low as 28.3 in 12 physical therapists from the United States.[189] PABS-BM scores have ranged from 26.7 in 12 US based physical therapists[189] to 41.4

in 42 physical therapists from Sweden.[44] The same 42 Swedish physical therapists had the lowest reported PABS-BPS scores (25.9) [44] and the highest scores have been reported in 42 physical therapists from the Netherlands (40.4).[165] The HC-PAIRS and PABS-BPS scores for the participants in this dissertation fell well within the reported scores from other studies. Scores on the PABS-BM subscale were on the low end of the reported values and were similar to a study that also included US based physical therapists. It is possible that US based physical therapists have less biomechanically-oriented attitudes and beliefs than therapists in other countries; however, there is only one other study using the 19-item PABS-PT scale in US based physical therapists and it only included 12 physical therapists.[189]

Several factors predicted the LBP-related attitudes and beliefs of physical therapists who participated in this study. The largest and most consistent predictor was physical therapist knowledge of pain neuroscience. Higher scores on the Neurophysiology of Pain Questionnaire (NPQ) were predictive of beliefs that were less biomedically-oriented and more biopsychosocially-oriented. This is not surprising given that the current science on pain suggests that pain is multifactorial and includes biomedical, psychological, and social factors.[229-231] The NPQ asks questions that are designed to test if respondents understand the complex, multifaceted nature of pain. Physical therapists with greater knowledge about this multifactorial nature will likely have attitudes and beliefs that align with this knowledge. The potential connection between knowledge and attitudes and beliefs was also supported by the predictive ability of entry-level degree, residency and fellowship training, and certifications. Physical therapists with an entry-level Doctorate degree, residency or fellowship training, and/or board certification were more likely to have biopsychosocially-oriented beliefs. This relationship may be at least partially explained by the impact education and certification have on NPQ scores. Fellowship (10.42) and residency trained (10.11) physical therapists had some of the highest NPQ scores and individuals with an entry-level Doctorate degree also had high NPQ scores (9.89). Physical therapists with an entry-level Doctorate degree (p=.010), board certification (p=.005) and who were fellowship trained (p=.030) had statistically significantly higher NPQ scores than physical therapists without the same training or certification. NPQ scores were higher for residency-trained physical therapists, but the difference was not statistically significant.

Physical therapist age, years of experience, caseload of LBP patients, and practice setting predicted between 1.6 and 5.6% of the variability in LBP-related attitudes and beliefs. Younger professionals (18-34 years) with less years of experience (5-9 years) had more biopsychosocially-oriented beliefs than older (≥55 years), more experienced physical therapists (≥ 25 years). This finding is consistent with studies from Fullen et al.,[63] Epstein-Sher et al.,[143] and Magalhaes et al.[171] that found physicians and physical therapists with less experience had lower scores on the PABS-BM. The trend towards more biomedically-oriented attitudes and beliefs in older more experienced clinicians may be related to clinical experience and/or education. It is possible that clinical experience reinforces stronger biomedically-oriented beliefs. Clinicians with more experience treating patients with bio-pathoanatomical (BPA) issues may develop beliefs that these BPA factors play a major role in the development and recovery from painful conditions. It is also possible that trends in education have changed and older, more experienced therapists have had less educational exposure to modern pain science and biopsychosocial concepts.

It was hypothesized that a personal history of LBP might have an influence on LBP-related attitudes and beliefs. This hypothesis was reasonable given the evidence that patients' personal experience has an influence on their pain-related beliefs.[57,58] A qualitative study by Askew et al. also found that physical therapists believed that their personal experience with pain had an impact on their attitude towards patients.[145] On the other hand, several quantitative studies have found that a personal history of LBP does not have an influence on the attitudes and beliefs of clinicians.[142,172,173] For example, Coudeyre et al found that a personal history of LBP did not influence the fear avoidance beliefs of French physicians. In this dissertation, the influence of LBP on the attitudes and beliefs of physical therapists was investigated in more detail than previous quantitative studies. Therapists were asked if they had an experience with LBP and the level of impact that pain had on their lives. It was hypothesized that LBP significantly affecting a physical therapist's life would have a more substantial influence on their attitudes and beliefs about LBP. In this study, 96.3% of the physical therapists had a history of LBP. Of those with a history of LBP, 58.9% (76) were minimally impacted by the pain and 10.1% (13) reported that LBP had a significant impact on their life. Despite taking a more nuanced look at the impact of LBP, it was still not a significant predictor of LBP-related attitudes and beliefs. It seems that, even though physical therapists perceive that their personal experience with pain has an impact on their perception of patients, it doesn't have an appreciable influence on their LBP-related attitudes and beliefs.

Multiple regression analysis produced predictive models for both PABS-BM and PABS-BPS. When building a model for HC-PAIRS, NPQ score was the only significant predictor. A model containing NPQ scores, board certification, and an age between 18-34 predicted 27.8%

of the variability in PABS-BM and 23.3% in PABS-BPS. The strongest predictor of PABS-BM scores was NPQ scores (standardized β= -.421) and the strongest predictor of PABS-BPS was board certification (standardized β= -.269), followed closely by NPQ scores (standardized β= -.255). This suggests that LBP attitudes and beliefs may be modifiable through education. Gaining an increased understanding of current pain science and obtaining the skills to become board certified may lead to LBP-related attitudes and beliefs that are more aligned with the biopsychosocial model. This is supported by several studies that have shown education, including pain science and biopsychosocial principles, leads to changes in LBP-related attitudes and beliefs. [44,125,141,165,166,180,185,187-189,232-235] For example, Colleary et al. looked at changes in NPQ and HC-PAIRS scores after providing education on pain science or a control education intervention that included red flags, Waddell's signs, and detecting tissue pathology.[187] The intervention group had significant changes in NPQ scores and HC-PAIRS scores, in the expected direction. The intervention group was also more likely to provide advice to return to work, exercise, stay active, and avoid bed rest. One study was found that showed no change in attitudes and beliefs after a 3-hour education session on pain science. Student physical therapists' NPQ and HC-PAIRS scores were measured at baseline, immediately after the education, and at 6 months. NPQ scores increased after the education, but there was no significant difference in HC-PAIRS at any time point. It is possible that one 3-hour session was not sufficient to cause a significant change in beliefs. The other studies that showed changes in attitudes and beliefs after education either included more than one session[44,163,165,232] or had one session that was longer than 3 hours. [164,233-235]

Impact of Beliefs on Outcomes

The other main objective of this dissertation was to investigate the impact of physical therapist LBP-related attitudes and beliefs on the outcomes of patients. To do this, the attitudes and beliefs data collected by the physical therapist survey was compared to the average Computerized Lumbar Functional Scale (CLFS) scores, average CLFS residual scores, and the average number of visits collected from Focus on Therapeutic Outcomes, Inc. (FOTO). The PABS-BPS subscales were not predictive of outcomes and the PABS-BM subscale was only predictive of average CLFS change for the 10-patient cut-off sample. HC-PAIRS score was a univariate linear predictor of average CLFS score, average CLFS residual score, and average number of visits in the 10-patient cut-off sample. When controlling for the number of patients seen, a linear model containing HC-PAIRS scores and the average change in the Fear Avoidance Beliefs Questionnaire (FABQ) predicted 16.1% of the variability in average CLFS change scores and 12.8% of the variability in the average number of visits. HC-PAIRS was also a univariate logistic predictor of average CLFS residual for the 10-patient cut-off sample. Receiver operating characteristic (ROC) curve identified a cut-off score of 30.50. This score had weak discriminatory value with a sensitivity of .564 and specificity of .641.

HC-PAIRS was a predictor of some patient outcomes in this study; however, the direction of the prediction was not in the expected directions. Physical therapists with higher HC-PAIRS scores, indicating a stronger belief that pain is associated with disability, had greater average CLFS change, greater average CLFS residual scores, and saw patients for fewer visits. Based on this, it is possible that physical therapists with beliefs that associate pain and disability act in a way that improves outcomes. Several studies have shown that higher HC-PAIRS scores are associated with certain clinician behaviors. [46,54,138,148] For example, Rainville et al. studied 82 physicians and found that higher HC-PAIRS scores were correlated with advice to avoid activity and stay out of work.[54] Houben et al. also found that physical therapist students with higher HC-PAIRS scores provided advice and recommended treatments that were more biomedically-oriented.[138] For example, students who scored higher on the HC-PAIRS were less likely to suggest that increasing exercise is safe, even if there is some pain. It has been suggested that the psychological- and behavioral-oriented treatment strategies seen in these studies are more effective than pure biomedical approaches.[29,85,236] Although the evidence for this is growing, there are some who caution that we may be moving too far from the biological part of the biopsychosocial model.[237] It is possible that physical therapists with beliefs that are too focused on psychological and social factors miss important biomedical components of LBP, leading to worse outcomes.

It is also possible that the predictive value of HC-PAIRs was a statistical anomaly in this dataset and is not generalizable outside of this sample. In this dissertation, the relationship between HC-PAIRS and outcomes was tested 33 times. Out of those 33 tests, HC-PAIRS was a significant predictor eight times (24.2%). Cross validation of the multiple regression findings using 2017 data from the same sample of physical therapists found that only one out of the four models including HC-PAIRS could be validated. The 10-patient sample CLFS change model, which included HC-PAIRS, was validated in the 2017 sample; however, the residual correlation was poor (.238), indicating low predictive value. Since this study was exploratory in nature, statistical safe guards for p-value inflation were not used. As a result, the significant findings for HC-PAIRS scores may have been influence by alpha inflation. If the alpha used in this dissertation was adjusted for multiple comparisons (α=.002, .05/33) HC-PAIRS would no longer be a significant predictor for any of the outcome measures.

As discussed in Chapter 2 of this dissertation, there is theoretical support for a connection between biopsychosocial-oriented beliefs and improved patient outcomes. These beliefs seem to influence clinician behaviors,[54,138,152] patient beliefs,[47,56,144] and clinician expectations of recovery and disability[66,157] in a way that will theoretically promote better outcomes. Despite this theoretical support, the results of this dissertation seem to align with other studies that have shown no connection between biopsychosocially-oriented attitudes and beliefs and outcomes.[144,148,163] It is possible that physical therapist LBP-related attitudes and beliefs have a small influence on outcomes, but this influence is hidden by the many other factors that can influence patient recover. It is also possible that physical therapist attitudes and beliefs have an impact on outcomes in a subset of patients. For example, the outcomes of patients with chronic LBP, or patients at risk for developing chronic LBP, may be more likely influenced by psychologically informed interventions.[133,134] It is also possible that patients with more extreme psychosocial influences, such as fear avoidance or catastrophizing, have greater sensitivity to the attitudes and beliefs of physical therapist. The data in this dissertation did not allow for subset analysis based on patient characteristics, so it is unclear if there is a subset of patients whose outcomes are influenced by clinician beliefs.

The most consistent predictor of outcomes in this dataset was changes in FABQ physical activity (FABQpa) scores. Change in average FABQpa score was a very consistent linear predictor for all outcomes except number of visits. It was not a univariate logistic predictor of any outcome, but was a multivariate predictor of average CLFS residual change categories.

There was a fairly large change in the strength of FABQpa prediction across the patient cut-off samples. For average CLFS change scores, FABQ change predicted 9.5% of the variance for the 5-patient cut-off sample, 10% in the 10-patient cut-off, and 20.6% in the 20-patient cut-off. This trend was also seen for CLFS residual with slightly lower predictive ability (7.2%, 8.2%, 18.5%). This relationship between FABQ scores and outcomes is consistent with previous work that has found an association between improved disability and reduction in FABQ scores.[36,59,238,239] The direction of causality in this relationship is still unclear and it is possible that improved disability leads to reduction in fear avoidance. Studies that have found a relationship between baseline FABQ scores and pain, disability, and return to work suggest that FABQ scores may be a mediator of improved outcomes; however, intake FABQpa scores in this dissertation were not consistently associated with outcomes. For example, intake FABQpa was a linear predictor of average CLFS change and number of visits only in the 20-patient cut-off sample. If FABQpa scores do mediate changes in outcomes, it may be important for clinicians to focus interventions on reducing fear avoidance in patients.[8] Clinicians with more biopsychosocially-oriented beliefs may be more likely to provide interventions that target a reduction in fear avoidance.

Implications

This dissertation is one of the first studies to investigate the impact of LBP-related attitudes and beliefs of physical therapists. These attitudes and beliefs are closely related to pain science knowledge, which implies that educational interventions aimed at improving knowledge are likely to increase the biopsychosocial orientation of attitudes and beliefs. Despite the apparent ability to influence the beliefs of physical therapists, this study questions the usefulness of efforts to change those beliefs. Physical therapist LBP-related attitudes and beliefs were not consistent predictors of patient outcomes. This suggests that although LBP-related attitudes and beliefs appear to be modifiable, there is no evidence that physical therapists with more biopsychosocial-oriented beliefs have better outcomes. Instead, the results of this dissertation suggest that physical therapists who associate pain with disability may have improved outcomes. As a result, if improving outcomes is the goal, this dissertation indicates that educational interventions aimed at increasing the biopsychosocial orientations of physical therapists may not be an effective use of resources.

Limitations and Delimitations

Several limitations and delimitations should be considered when interpreting the results of this study. These limitations and delimitations will be discussed in two categories. The first category is limitations and delimitations regarding the physical therapists used in this dissertation. The physical therapists in this dissertation were users of the FOTO outcomes registry. This is a commercial outcomes service that is used by only a small number of physical therapists in the US. Physical therapists who use the FOTO system may not accurately represent US physical therapists. The obtained sample was one of convenience and only represented 0.6% of FOTO users. As a result, it is possible that the sample was biased and cannot be generalized to other FOTO users or to US physical therapists who are not FOTO users.

In this dissertation, physical therapist attitudes and beliefs were measured prospectively, but outcomes data was retrospective. As a result, it is unclear what the physical therapists' beliefs were when they were treating the patients included in this dissertation. To explore this potential limitation, survey respondents were asked if their beliefs had changed over the past year. Approximately 81% of the respondents indicated that they had experienced minimal to no change in their beliefs over the past year. Pilot testing also suggested that scores on the HC-PAIRS and PABS-PT were stable over a 1-year period. There was no difference in outcomes based on change in beliefs and change in beliefs did not have a significant impact on the predictive models.

There was also no way to control for who provided the physical therapy services. In the FOTO system, patients are assigned to a provider based on who performs the initial evaluation. It is possible that other physical therapy providers delivered care for a patient who was assigned to a different physical therapist in the FOTO system. To mitigate this limitation, physical therapists were asked to identify the percentage of their patients seen by other physical therapy providers. This variable was used in regression modeling when it significantly influenced the model.

The second category of limitations and delimitations pertains to the patient data. The patient data only included patients who had complete CLFS scores at the initial evaluation and discharge. It is unclear what percentage of patients seen by each physical therapist were included in this dataset. It is possible that a significant number of patients were eliminated because they did not have a discharge CLFS score. There may have been non-random factors that influenced which patients completed the discharge CLFS. For example, patients who were not responding well to treatment may have been more likely to stop treatment sessions before a follow-up or discharge CLFS score was obtained. This could bias the sample, leaving a higher percentage of improved patients in the dataset.

FOTO only provided mean patient data for each participating physical therapist. This limited the analysis that could be performed on the data. For example, specific patient characteristics could not be controlled for in the modeling of raw CLFS scores and average number of visits. The lack of individualized data also prevented sub-group analysis based on factors such as chronicity and FABQpa scores. Only having mean data also reduced the ability to screen the patient data for outliers. Outlier analysis could only be performed on the means provided by FOTO. This may have been particularly problematic for physical therapists with only a small number of completed patient cases. To address this, three samples were analyzed based on the number of completed cases.

Recommendations

Based on the results of this dissertation, the attitudes and beliefs of physical therapists do not appear to have a major impact on the outcomes of patients. As a result, if improving outcomes is the goal, there is no support for spending time and resources in an attempt to influence the attitudes and beliefs of physical therapists. Educating physical therapists on the most current pain neuroscience may still be useful, but it is unlikely that changes in LBP-related attitudes and beliefs due to education will have a significant influence on patient outcomes.

Future studies should take two broad approaches. One approach should be replication studies that utilize large datasets. It is possible that the results of this dissertation are biased due to the limitations of the data. Replication studies that utilize a more representative population of physical therapists, include raw patient data, and contain more information about dropouts may produce different results. The other suggested approach is to perform prospective studies with methodology that controls for potential confounding variables. For example, these studies could better control for changes in physical therapist beliefs, the influence of other physical therapy providers, the impact of dropouts, and they could better assess the influence of attitudes and beliefs on the clinical behaviors of the treating physical therapists.

Summary

The LBP-related attitudes and beliefs of physical therapists in the US are similar to those in other countries. The average PABS-BM score for participants in this dissertation was towards the low end of the reported values, suggesting that the physical therapists in this sample had attitudes and beliefs that were less biomedically-oriented. Several factors predicted LBP-related attitudes and beliefs, with the most consistent predictor being knowledge of current pain science. The LBP-related attitudes and beliefs of physical therapists were not consistent predictors of outcomes. HC-PAIRS scores were found to be related to outcomes in 8 of the 33 performed analyses; however, this relationship was not in the predicted direction. Physical therapists who believed there was a strong relationship between pain and disability had improved outcomes. Limitations of this dissertation include a potentially biased sample of physical therapists, an inability to control certain variables, and limited information about individual subjects. Future studies should attempt to replicate these findings. In addition, prospective studies with better controls should be performed.

Appendix

Demographic Survey

Select the answer that best describes your current role in the field of physical therapy.	○ Physical therapist ○ Physical therapist assistant ○ Other
What is your current age?	○ 18-24 ○ 25-34 ○ 35-44 ○ 45-54 ○ 55-64 ○ 65-75 ○ 75 years or older
What gender identity best describes you?	○ Male ○ Female ○ Transgender Male ○ Transgender Female ○ Other ○ Prefer Not to Answer
Which ethnicity/race best describes you?	○ White, Non-Hispanic ○ Hispanic or Latino ○ Black or African American, Non-Hispanic ○ Native American ○ Asian or Pacific Islander ○ Other ○ Prefer Not to Answer
How many years have you been a licensed physical therapist or physical therapist assistant?	○ Less than 4 years ○ 5-9 ○ 10-14 ○ 15-19 ○ 20-24 ○ 25 years or greater
What was your entry-level degree?	○ Bachelor's (e.g. BSPT) ○ Master's (e.g. MPT) ○ Doctorate (e.g. DPT)
Please indicate if you have completed any of the following post-graduate programs. (check all that apply)	○ None ○ tDPT ○ PhD ○ DsC ○ Residency ○ Fellowship ○ Other
Please indicate if you have obtained any of the following certifications. (check all that apply)	○ None ○ Board Certification in Orthopedics ○ Board Certification in Sports ○ Board Certification in Geriatrics

	○ Manual Therapy Certification ○ Other
What setting(s) do you currently practice in? (check all that apply)	○ Private Practice Outpatient Orthopedics ○ Hospital-Based Outpatient Orthopedics ○ Rehabilitation Facility Based Outpatient Orthopedics ○ Other Outpatient Setting ○ Inpatient ○ Other
What percentage of your overall caseload consists of patients with low back pain as their primary complaint?	○ None ○ Less than 10% ○ 10-24% ○ 25-50% ○ Greater than 50%
Approximately what percentage of your patients with low back pain are seen by other physical therapy providers within your clinic (i.e. other physical therapists or assistants)	0-------------------------------100%
Of those patients seen by other physical therapy providers in your clinic, what is the usual percentage of care provided by you?	0--------------------------------100%
Have you ever experienced low back pain?	○ Yes ○ No
How large of an impact has back pain had on your life?	○ None ○ Minimal ○ Significant
On a typical week, how often do you exercise	○ Not at all ○ 1 time a week ○ 2 times a week ○ 3 times a week ○ 4 times a week ○ 5 times a week ○ More than 5 times a week
On a typical week, what type of exercise do you perform? (Check all that apply)	○ Cardiovascular exercises (e.g. running, walking, biking) ○ Machine based strength training ○ Free weight based strength training ○ Body weight exercises ○ High intensity interval training
How have your attitudes and beliefs about back pain changed in the past year?	○ There has been no change ○ There has been minimal change ○ There has been a significant change
What factor(s) influenced your change in attitudes and beliefs? (check all that apply)	○ A book(s) ○ A research article(s) ○ A colleague(s)

	○ A course(s) ○ Other

Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS), **13-item Version**

Instructions: Please respond by selecting the response that most closely describes the way you feel about each of the following statements.

1. Chronic back pain patients can still be expected to fulfill work and family responsibilities, despite pain.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

2. An increase in pain is an indicator that a chronic back pain patient should stop what he/she is doing until the pain decreases.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

3. Chronic back pain patients cannot go about normal life activities when they are in pain.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

4. If their pain would go away, chronic back pain patients would be every bit as active as they used to be.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

5. Chronic back pain patients should have the same benefits as the handicapped because of their chronic pain problems.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

6. Chronic back pain patients owe it to themselves and those around them to perform their usual activities even when their pain is bad. *

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

7. Most people expect too much of chronic back pain patients, given their pain.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

8. Chronic back pain patients have to be careful not to do anything that might make their pain

worse.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

9. As long as they are in pain, chronic back pain patients will never be able to live as well as they did before.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

11. Chronic back pain patients have to accept that they are disabled persons, due to their chronic pain.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

12. There is no way that chronic back pain patients can return to doing the things that they used to do, unless they first find a cure for their pain.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

14. Even though their pain is always there, chronic back pain patients often don't notice it at all when they keeping themselves busy. *

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

15. All of the chronic back pain patients' problems would be solved if their pain would go away.

☐ Completely Disagree	☐ Disagree	☐ Disagree Somewhat	☐ Neutral	☐ Agree Somewhat	☐ Agree	☐ Completely Agree

Scoring: Completely Disagree (1), Disagree (2), Disagree Somewhat (3), Neutral (4), Agree Somewhat (5), Agree (6), Completely Agree (7).
* Items 1,6, and 14 are reverse scored.

The Pain Attitude and Beliefs Scale For Physical Therapists, Houben '05 Version

Instructions: The purpose of this list is to analyze how you approach the most common forms of back pain. This excludes back pain resulting from a radicular syndrome, cauda equina syndrome, fractures, infections, inflammation, a tumor or metastasis.

1=totally disagree 2= largely disagree 3= disagree to some extent 4= agree to some extent 5= largely agree 6= totally agree

6†	Mental stress can cause back pain even in the absence of tissue damage	1 2 3 4 5 6
7†	The cause of back pain is unknown	1 2 3 4 5 6
10*	Pain is a nociceptive stimulus, indicating tissue damage	1 2 3 4 5 6
11†	A patient suffering from severe back pain will benefit from physical exercise	1 2 3 4 5 6
12†	Functional limitations associated with back pain are the result of psychosocial factors	1 2 3 4 5 6
14*	Patients with back pain should preferably practice only pain free movements	1 2 3 4 5 6
17†	Therapy may have been successful even if pain remains	1 2 3 4 5 6
20*	Back pain indicates the presence of organic injury	1 2 3 4 5 6
22*	If back pain increases in severity, I immediately adjust the intensity of my treatment accordingly	1 2 3 4 5 6
23*	If therapy does not result in a reduction in back pain, there is a high risk of severe restrictions in the long term	1 2 3 4 5 6
24*	Pain reduction is a precondition for the restoration of normal functioning	1 2 3 4 5 6
25*	Increased pain indicates new tissue damage or the spread of existing damage	1 2 3 4 5 6
27†	There is no effective treatment to eliminate back pain	1 2 3 4 5 6
29†	Even if the pain has worsened, the intensity of the next treatment can be increased	1 2 3 4 5 6
30*	If patients complain of pain during exercise, I worry that damage is being caused	1 2 3 4 5 6
31*	The severity of tissue damage determines the level of pain	1 2 3 4 5 6
33†	Learning to cope with stress promotes recovery from back pain	1 2 3 4 5 6
34†	Exercises that may be back straining should not be avoided during treatment	1 2 3 4 5 6
35*	In the long run, patients with back pain have a higher risk of developing spinal impairments	1 2 3 4 5 6

* = biomedical subscale, † = biopsychosocial subscale

Neurophysiology of Pain Questionnaire

		T	F	U
1	It is possible to have pain and not know about it			
2	When part of your body is injured, special pain receptors convey the pain message to your brain			
3	Pain only occurs when you are injured or at risk of being injured			
4	When you are injured, special receptors convey the danger message to your spinal cord			
5	Special nerves in your spinal cord convey 'danger' messages to your brain			
6	Nerves adapt by increasing their resting level of excitement			
7	Chronic pain means that an injury hasn't healed properly			
8	The body tells the brain when it is in pain			
9	Nerves adapt by making ion channels stay open longer			
10	Descending neurons are always inhibitory			
11	Pain occurs whenever you are injured			
12	When you injure yourself, the environment that you are in will not affect the amount of pain you experience, as long as the injury is exactly the same			
13	The brain decides when you will experience pain			

T= True, F= False, U= Undecided

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