Fall 2009

Health locus of control, self-efficacy, and multidisciplinary intervention for chronic back pain

Nicole Hochhausen Keedy
University of Iowa

HEALTH LOCUS OF CONTROL,

SELF-EFFICACY, AND MULTIDISCIPLINARY

INTERVENTION FOR CHRONIC BACK PAIN

by

Nicole Hochhausen Keedy

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the
Doctor of Philosophy degree in
Psychological and Quantitative Foundations
in the Graduate College of
The University of Iowa

December 2009

Thesis Supervisor: Professor Elizabeth Altmaier

ABSTRACT

Chronic back pain is costly and potentially disabling, with low response to medical procedures. Poor physical and mental health demonstrate correlation with chronic back pain. The current study investigated the value of using health-related locus of control and pain-related self-efficacy to predict physical and mental health outcomes following multidisciplinary intervention for chronic back pain. Form C of the Multidimensional Health Locus of Control scales and the Chronic Pain Self Efficacy scale were administered to 28 males and 33 females ages 28 to 72 completing chronic back pain rehabilitation. Locus of control, self-efficacy, and physical and mental health demonstrated treatment-related changes, with notable improvements in physical and mental health. Regression analyses examined the value of pre-treatment health locus of control and pain-related self-efficacy as predictors of physical and mental health one month following treatment. Higher internal and lower doctor health locus of control, and higher self-efficacy at baseline predicted higher lift scores one month after treatment. Higher baseline self-efficacy also predicted better physical functioning and lower disability at one month. Pain-related self-efficacy and health locus of control may be valuable predictors of treatment benefit for chronic back pain patients. Limitations included low sample size.

Abstract Approved: ____________________________________
Thesis Supervisor

____
Title and Department

____
Date

HEALTH LOCUS OF CONTROL,

SELF-EFFICACY, AND MULTIDISCIPLINARY

INTERVENTION FOR CHRONIC BACK PAIN

by

Nicole Hochhausen Keedy

A thesis submitted in partial fulfillment
of the requirements for the
Doctor of Philosophy degree in
Psychological and Quantitative Foundations
in the Graduate College of
The University of Iowa

December 2009

Thesis Supervisor: Professor Elizabeth Altmaier

Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

Nicole Hochhausen Keedy

has been approved by the Examining Committee for the thesis requirement for the Doctor of Philosophy degree in Psychological and Quantitative Foundations at the December 2009 graduation.

Thesis Committee: ____________________________________
Elizabeth Altmaier, Thesis Supervisor

____
Valerie Keffala

____
Sheila Barron

____
Saba Rasheed Ali

____
Megan Foley Nicpon

____
Ernest Found

To Morgan, Mom, Dad, Natolie, and Nakila

ACKNOWLEDGMENTS

The UI Spine Center deserves recognition for a wealth of assistance with this project, especially Pam Lee for providing resources and assisting with data collection, Teresa Kober for endless assistance with recruitment, Ann Vogel for providing expertise regarding return to work, and Dr. Joseph Chen for providing suggestions and supporting recruitment efforts. Special thanks to Heather Rickels for invaluable assistance with data collection, Joyce Woody for meticulous attention to data management, and Alison Klaassen for assistance with data exportation. Thank you to Derek Turesky for mailing follow-up forms and assisting with data collection, and to Benjamin Tallman for administering questionnaires. Additional thanks to Dr. Heidi Christianson and Jin Gong for suggestions regarding data analysis, and to Drs. Jennifer Kauder , Kathryn Moss, and Stefanie Greenberg for their input regarding manuscript preparation.

To my dissertation committee I offer endless thanks for your support, assistance, and time. Thank you to Dr. Elizabeth Altmaier for providing support and advice through each step of the process, for offering crucial guidance in navigating the research process, and for supplying multiple, detailed edits, revisions, and suggestions. Thanks to Dr. Valerie Keffala for assisting with the formulation of the research topic, providing information and expertise, offering support and encouragement, guaranteeing access to participants for recruitment, providing detailed edits of the manuscript, and assisting with data collection. To Dr. Sheila Barron, thank you for encouragement and dedicated attention to my methods, analyses, and results, with multiple revisions and essential suggestions. Additional thanks to Drs. Saba Rasheed Ali, Megan Foley-Nicpon, and Ernest Found for reading and providing support, insight, and edits for this manuscript.

ABSTRACT

Chronic back pain is costly and potentially disabling, with low response to medical procedures. Poor physical and mental health demonstrate correlation with chronic back pain. The current study investigated the value of using health-related locus of control and pain-related self-efficacy to predict physical and mental health outcomes following multidisciplinary intervention for chronic back pain. Form C of the Multidimensional Health Locus of Control scales and the Chronic Pain Self Efficacy scale were administered to 28 males and 33 females ages 28 to 72 completing chronic back pain rehabilitation. Locus of control, self-efficacy, and physical and mental health demonstrated treatment-related changes, with notable improvements in physical and mental health. Regression analyses examined the value of pre-treatment health locus of control and pain-related self-efficacy as predictors of physical and mental health one month following treatment. Higher internal and lower doctor health locus of control, and higher self-efficacy at baseline predicted higher lift scores one month after treatment. Higher baseline self-efficacy also predicted better physical functioning and lower disability at one month. Pain-related self-efficacy and health locus of control may be valuable predictors of treatment benefit for chronic back pain patients. Limitations included low sample size.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

α Alpha: Cronbach's index of internal consistency

Adj. Adjusted

β Beta: Standardized coefficient derived from the slope of a regression line representing the strength and direction of an association between two variables

Δ Delta: Symbol signifying "change in" the value it precedes

df Degrees of freedom: number of values free to vary after certain restrictions have been placed on data

F Fisher's *F* ratio: A ratio of two variances

M Mean: the sum of a set of values divided by the number of values in the set

N Statistical notation for sample size

η_p^2 Partial eta-squared: the proportion of total variability attributable to a particular factor

p Probability of obtaining the observed value or a more extreme value if the null hypothesis is true

R^2 R-squared: the proportion of variability in a data set that is accounted for by a statistical model

r Pearson product-moment correlation

SD A statistical measure of variability in a data set; the square root of the variance

t Computed value of a *t* test demonstrating distance from the mean

$<$ Less than

$=$ Equal to

CHAPTER 1

INTRODUCTION

People in the United States make approximately 19 million medical office visits for lower back pain each year (Katz, 2006). The majority of individuals with low back pain experience acute episodes, recovering within three to six months (Claiborne, Vandenburgh, Krause, & Leung, 2002). The National Center for Health Statistics considers back pain lasting beyond 90 days a chronic condition (Claiborne et al., 2002). The current study focuses on chronic back pain that is nonmalignant in nature. Although it may become a chronic condition, with regard to the current study, chronic back pain (i.e., nonmalignant back pain) is not considered a disease state or illness, as it does not imply a progressive organ or system dysfunction outside of what may have been caused by a direct injury.

Chronic back pain leads to significant costs in terms of lost workdays, lower productivity in the workplace, and healthcare costs. In fact, of all workers who report lower back pain, the 5% who never return to work account for 75% of costs for work-related back pain (Katz, 2006). In addition to loss of productivity, chronic back pain also takes a psychological toll, being associated with decreased social functioning, family stress, decreased income, insomnia, irritability, anxiety, and depression (Claiborne et al., 2002). Chronic back pain is commonly considered difficult to treat, often requiring referrals to multidisciplinary treatment programs developed to address medical, physical, and psychological facets of dealing with chronic back pain (Guzmán et al., 2001).

Due to high costs of chronic back pain, poor mental and physical correlates, and low response to treatment, the tasks of predicting treatment outcomes and developing maximally beneficial treatment programs for individuals with this health problem have received growing emphasis in recent years. Numerous physical and mental factors have been examined as potential predictors of treatment outcome, with goals to (1) improve treatment approaches and (2) screen for patients with the highest likelihood to benefit from what is expected to be costly treatment. Research has examined the potential for factors such as health locus of control and pain-related self-efficacy to predict treatment outcomes for chronic back pain. Furthermore, recent research has examined the efficacy and effectiveness of multidisciplinary treatment models as they have grown in popularity (e.g., Guzmán et al., 2001).

This study was designed to investigate possible predictors of outcome from multidisciplinary treatment for chronic back pain, with specific attention to health-related locus of control and pain-related self-efficacy. The locus of control (LOC) construct was derived within Social Learning Theory (SLT; Rotter, 1966; Rotter, 1982; Rotter & Hochreich, 1975), to explain how expectancies can influence the relationship between reinforcements and behaviors. To varying degrees, people have generalized expectancies that (1) reinforcements result directly from their own behavior, that (2) reinforcements result from behaviors of others, or that (3) reinforcements arise due to chance. The distinction between internal and external attributions of the cause of reinforcements is referred to as locus of control. Individuals are more likely to engage in behaviors when they perceive that reinforcements previously arose directly because of their own behavior (internal LOC). When individuals perceive that reinforcements occurred due to others' behaviors or due to chance factors (external LOC), the behavior potential does not increase.

Health locus of control (HLOC) refers to LOC specifically related to health behaviors (Wallston & Wallston, 1982). That is, HLOC describes the belief that one's health is dependent upon internal versus external factors. As measured by the Multidimensional Health Locus of Control (MHLC) scales (Wallston, Wallston, & DeVellis, 1978), HLOC consists of three major dimensions. Internal health locus of control (IHLC) refers to an individual's belief that her or his health is dependent upon her or his own behavior; chance locus of control (CHLC) refers to the belief that chance factors determine health outcomes; and powerful others locus of control (PHLC) refers to an individual's belief that her or his health is dependent upon the behaviors of powerful others such as medical doctors. The PHLC dimension is further divided on one version, Form C, of the MHLC to indicate whether LOC beliefs are directed specifically toward medical professionals or toward others in general. Thus, on Form C of the MHLC, four dimensions of HLOC are represented: internal (IHLC), chance (CHLC), doctor (DHLC), and other (OHLC). The bulk of research using the MHLC, however, has focused more on Form A of the MHLC, which combines OHLC and DHLC into one dimension of PHLC. Studies have demonstrated that, in comparing the MHLC subscales, IHLC is related to better physical and mental well-being (Pucheu, Consoli, D'Auzac, Français, & Issad, 2004) and more proactive health behaviors (Bonetti et al., 2001), CHLC is related to poorer physical and mental well-being (Bonetti et al., 2001) and less proactive health behaviors (O'Carroll, Smith, Grubb, Fox, & Masterson, 2001), and PHLC is related to stronger adherence to medical recommendations but higher likelihood of chronic pain or disability (Wallston & Wallston, 1982). Based on these findings, it appears the HLOC construct may be useful in predicting the likelihood of back pain patients to benefit from multidisciplinary intervention (MI). However, these studies did not include back pain patients. Additionally, they were cross-sectional and correlational in nature, precluding causal inferences. Further investigation of the relationship between HLOC and back pain is warranted.

The developers of the MHLC scales have noted that measurement of HLOC alone offers limited value for predicting health behaviors (Wallston, 1991). They have suggested measuring other constructs, such as self-efficacy, in combination with HLOC, to increase the ability to predict health behaviors. Bandura (1997) developed the self-efficacy construct within Social Cognitive Theory (SCT). Self-efficacy refers to an individual's belief in her or his ability to perform a particular behavior. According to SCT, the potential for a behavior to occur increases as an individual's self-efficacy for the behavior increases. Theoretically, behavior potential increases with increased internal LOC and higher self-efficacy. That is, a behavior is more likely to occur if an individual (1) believes positive outcomes are directly due to the behavior and (2) perceives oneself as capable of performing the behavior.

According to Bandura (1997), self-efficacy instruments offer the most predictive value when particularized to the behavior of interest. Therefore, the proposed study will specifically examine pain-related self-efficacy, or individuals' belief in their ability to perform behaviors relevant to managing or coping with pain. Studies with back pain patients have found that higher pain-related self-efficacy is correlated with more maintenance of treatment benefits (Altmaier, Russell, Kao, Lehmann, & Weinstein,1993), more effort in functional capacity evaluations (Kaplan, Wurtele, & Gillis, 1996), better physical functioning (Estlander, Vanharanta, Moneta, & Kaivanto, 1994), and shorter duration of back pain (Brox, Storheim, Holm, Friis, and Reikeras, 2005). Only one study offered evidence of the predictive value of self-efficacy over time (Altmaier et al.,1993), whereas other studies were correlational. Further examination of this construct as a predictor of outcome would lend further support to its theoretical relationship to pain management behavior.

Multidisciplinary intervention (MI) refers to the use of physical intervention with any combination of psychological, social, and/or occupational interventions (Guzmán et al., 2001). The term *multidisciplinary* typically refers to the combination of multiple disciplines in treatment, which may include but does not necessarily imply collaboration between the various disciplines in treatment planning and intervention. The inclusion of this type of collaboration on a multidisciplinary treatment team is generally referred to as *interdisciplinary* treatment (Warren, Houston, & Luquire, 1998). For the purposes of this paper, MI will encompass any approach that involves multiple disciplines, including interdisciplinary treatment. Individuals with chronic pain are commonly referred for MI after other treatments fail (Guzmán et al., 2001). However, MI programs for back pain encompass a wide variety of treatment protocols, and efficacy studies show inconsistent results (e.g., Guzmán et al., 2001; Claiborne et al., 2002). Therefore, studies examining predictors of benefit from MI may contribute to improvement of these programs.

Due to high costs of back pain intervention, it is important to continue improving intervention methods for this population. Research to date has offered some evidence that HLOC and pain-related self-efficacy are correlated with physical and mental well-being and treatment outcomes. An examination of their relationship to outcomes following treatment would significantly add to the extant literature on MI for back pain patients. Theoretically, it is expected that higher levels of each variable will relate to better physical and mental outcomes following intervention. Based on SCT, if a patient felt efficacious in performing a pain management behavior such as exercise, the patient would be more likely to exercise. Adding the tenets of SLT would suggest that the patient would be more likely to exercise if pain reduction were viewed as a direct result of exercising. Therefore, the combination of high pain-related self-efficacy and internal HLOC may offer the highest likelihood of benefiting from MI.

Another possibility supported by the literature is that intervention leads to changes in HLOC and pain-related self-efficacy. It is possible that intervention-related changes in these variables are related to physical and mental health outcomes. Therefore, it is important to study the change in HLOC and self-efficacy over time in addition to their relationship to post-intervention physical and mental health outcomes.

This research study purported to examine three main relationships. First, the study was designed to examine treatment-related change in predictor variables (HLOC and pain-related self-efficacy) and outcome variables (functional capacity, self-reported physical and mental health, and depression level). Next, it aimed to examine the relationship of pre-treatment self-efficacy and HLOC (predictors) to post-treatment functional capacity, disability, return to work, self-reported physical and mental health, and depression (outcomes). Finally, this study intended to examine the relationship of MI-induced change in HLOC and pain-related self-efficacy to physical outcomes (functional capacity, disability level, return to work and self-reported physical health) and mental outcomes (self-reported mental health and depression) measured one month following treatment. The study included patients receiving MI through the University of

Iowa Spine Center (from this point referred to as the Spine Center). Detailed theoretical background, research questions, and methods for this study are provided in the following chapters.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the literature relevant to this study, which focused on health locus of control (HLOC) and pain-related self-efficacy as predictors of treatment outcome in a multidisciplinary treatment program for chronic back pain. First, this chapter discusses the construct of locus of control and its development within Social Learning Theory (Rotter, 1966, 1982). Second, this chapter defines locus of control related to health behavior, specifically as measured by the Multidimensional Health Locus of Control (MHLC) scale. This section of the chapter discusses correlates of internal and external health locus of control, primarily in individuals with back pain. Third, this chapter defines self-efficacy (Bandura, 1986, 1997, 2006) and outlines research examining the predictive value of self-efficacy in chronic back pain treatment. Fourth, this chapter defines and describes MI for back pain, including the benefits of such intervention, and it reviews relevant literature. Finally, this chapter outlines limitations of extant research on HLOC, self-efficacy and MI for chronic back pain, and outlines the research questions proposed to expand the literature on these topics, specifically examining the relationship between HLOC and self-efficacy in predicting outcomes after receiving MI for chronic back pain.

Locus of Control

Rotter developed the locus of control construct as one component of Social Learning Theory (SLT; Rotter, 1966, 1982; Rotter & Hochreich, 1975). According to SLT, the likelihood of a given behavior occurring, i.e., the behavior potential, varies according to (a) the expectancy that a particular reinforcement will occur as a result of the behavior, (b) the value of the expected reinforcement, and (c) the psychological situation, i.e., the components of a given situation, including meaning attached by the individual to various components of the situation (Rotter, 1982). For example, whether an individual decides to study for a particular exam depends on the expectancy that studying will result in a desired reinforcement, such as receiving an A, the value to the student of receiving an A, and the meanings attached to the situation (e.g., whether one's social group is also studying for the exam). Within this theory, reinforcement is "any action, condition, or event which affects the individual's movement toward a goal" (p.94; Rotter, 1982). According to SLT, positive reinforcement refers to any consequence that increases the likelihood that a behavior will occur (Rotter, 1982).

Numerous variables affect the expectancy of a reinforcement occurring as the result of a particular behavior. Expectancy is influenced by an individual's previous experiences in a particular situation, as well as generalized expectancies for behaviors and resulting reinforcements in similar situations. One type of generalized expectancy concerns whether an individual views a causal relationship between one's own behavior and the reinforcements that follow. That is, individuals develop generalized expectancies that either (a) a particular reinforcement results directly from the individual's behavior or attributes, or (b) reinforcement results from other factors, such as luck, fate, chance, powerful others or factors that are "unpredictable because of the great complexity of forces surrounding them" (p.171). In the former circumstance, when reinforcement is viewed as a result of one's own behavior, *internal* expectancies for reinforcement exist. Alternatively, when reinforcement is viewed as a result of other factors, *external* expectancies for reinforcement exist (Rotter, 1982).

Whether an individual perceives reinforcement as resulting directly from one's behavior influences whether the behavior potential is strengthened or weakened by the occurrence of a given reinforcement. For example, if a student believes that good grades in the past have resulted from luck, chance, or the generosity of the professors, the student may be less likely to study than a student who believes good grades have resulted from knowledge acquired while studying, assuming all other factors are equal. Therefore, the likelihood of an individual engaging in a particular behavior is impacted by whether previous behavioral reinforcements were perceived as caused by internal or external factors. The distinction between generalized expectancies as primarily internal or primarily external has become known as the "locus of control" distinction (Rotter & Hochreich, 1975).

Locus of control is a continuous variable, theoretically approximating the normal curve in the population (Rotter & Hochreich, 1975). Generalized internal or external expectancies are considered fairly consistent within individuals (Rotter & Hochreich, 1975). Research has shown that an individual with more internal expectancies is more likely to "(a) be more alert to those aspects of the environment which provide useful information for his future behavior; (b) take steps to improve his environmental condition; (c) place greater value on skill or achievement reinforcements and be generally more concerned with his ability, particularly his failures; and (d) be resistive to subtle attempts to influence him" (p. 210; Rotter & Hochreich, 1975). A meta-analysis concluded that expectancies of control by chance factors and powerful others were associated with higher levels of depression. Furthermore, the absence of internal expectancies of control was correlated with higher levels of depression (Presson &

Benassi, 1996). In a longitudinal study, children's locus of control with regard to academic performance was predictive of adulthood health outcomes (Gale, Batty, & Deary 2008). Specifically, individuals who had a more internal academic LOC in childhood were less likely as adults to be obese, overweight, or psychologically distressed, and they were less likely to rate their health as fair or poor as compared to individuals with less internal LOC in childhood. Furthermore, women in the study with more internal LOC in childhood demonstrated reduced risk of high blood pressure in adulthood as compared to women with less internal LOC.

Some clarifications regarding the locus of control construct are important to consider. For instance, Rotter and Hochreich (1975) noted that broad measures of generalized expectancy offer predictions for a wide variety of situations that are limited in clarity, and more narrow measures of generalized expectancy offer clearer predictions for a limited set of situations. Additionally, although it is commonly assumed that individuals with an internal locus of control are more psychologically healthy, Rotter and Hochreich stated that either end of the continuum could be problematic. Finally, locus of control must be distinguished from the determination of whether someone is internally or externally controlled. That is, locus of control does not describe whether an individual behaves in accord with one's own goals/desires versus the desires of others. Rather, locus of control describes whether an individual perceives particular reinforcements as resulting from one's own behavior or other factors such as chance, luck, or powerful others.

Health Locus of Control

The locus of control construct is useful for studying expectancies for health-related behaviors (Wallston & Wallston, 1982). The application of the locus of control construct in relation to health behaviors has become known as health locus of control (HLOC). As defined by Wallston and colleagues, HLOC refers to “the degree to which individuals believe that their health is controlled by internal versus external factors” (p. 68; Wallston & Wallson, 1982). This construct has been measured predominantly using the Multidimensional Health Locus of Control (MHLC) scales, published in 1978 by Wallston, Wallston, and DeVellis. The MHLC was developed to measure HLOC as one factor in SLT accounting for the likelihood that an individual will engage in a particular health-related behavior.

The MHLC scale includes three main dimensions of health-related expectancies for control. Externality contains two components: an individual’s expectancies that powerful others (e.g., doctors, nurses, family, friends) control his or her health (PHLC) and expectancies that chance factors (fate, luck, chance) control his or her health (CHLC). The third scale measures internal health control expectancies (IHLC). Notably, Form C of the MHLC splits the PHLC dimension into two subscales: expectancies specifically related to medical professionals or doctors (DHLC), and expectancies of control by others in general (OHLC). Form C was designed to assess HLOC in reference to any medical condition. Although back pain is considered a medical condition, it is not considered an illness or disease unless in the presence of a primary illness such as cancer. As mentioned previously, the terms illness or disease refer to organically-based conditions reflecting dysfunction of a body system outside that caused by direct bodily injury. The subscales of the MHLC are treated separately and are not combined to create a continuum from external to internal. Therefore, low scores on the IHLC do not imply high levels of externality and low scores on the DHLC, OHLC or CHLC do not imply high levels of internality. It is possible for individuals to receive high scores on any combination of the subscales, although it is unlikely that any individual would receive high scores on all subscales or low scores on all subscales (Wallston & Wallston, 1982). Furthermore, unlike the general locus of control concept, which is theoretically a stable, trait-like characteristic, the MHLC defines HLOC as a characteristic midway between a trait and a transitory, situation-specific manner of interpretation.

Numerous studies have examined correlates of the MHLC subscales, primarily using Form A, which utilizes IHLC, CHLC, and PHLC without further distinguishing between the two subtypes of PHLC (i.e., DHLC and OHLC). Wallston and Wallston (1982) discussed some of the more common findings among such studies. Scores on the IHLC scale were positively correlated with life satisfaction, will to live, desire for control of the healthcare delivery process, information-seeking behaviors, and adherence to health recommendations (especially when health was highly valued), and negatively correlated with report of physical symptoms. PHLC scores were positively correlated with information-seeking and adherence to treatment recommendations, and negatively correlated with desire for control over the healthcare delivery process. CHLC scores were found positively correlated with level of depression and report of physical symptoms, and negatively correlated with desire for control over the healthcare delivery process. Wallston and Wallston noted that the most consistent of these findings was the positive correlation between CHLC scores and depression levels. Additionally, they stated that chronic patient samples tended to be higher on CHLC and PHLC than healthy people, people with physical disabilities had higher PHLC than others, and MHLC subscales did not appear to predict preventive health behaviors.

The studies mentioned by Wallston and Wallston (1982) lend support to their HLOC construct, demonstrating expected correlations with each subscale. The results imply that higher levels of IHLC correlate with more active involvement in healthcare treatment, and better physical and mental health. Additionally, it appears individuals who believe powerful others (e.g., doctors) have control of their health are more likely than others to utilize or adhere to services delivered by powerful others, they are more likely to have chronic pain and/or physical disability, and they have low desire for personal control over healthcare services. Furthermore, increased belief that chance factors determine health outcomes appears to coincide with poorer physical and mental well-being, increased likelihood of having chronic pain, and decreased desire for control over health treatment. Therefore, the studies support more active involvement in the healthcare process and increased physical and mental health in individuals with internal HLOC as compared to those with external HLOC, although individuals with PHLC may be actively involved in treatment in terms of following direct recommendations from powerful others.

To the knowledge of the current author, three reviews in the past 20 years have discussed health locus of control research (i.e., Oberle, 1991; AbuSabha & Achterberg, 1997; Park & Gaffey, 2007). Oberle reviewed locus of control research in the nursing literature, including studies examining HLOC as it related to: health promotion behaviors, compliance to treatment, substance abuse, cancer practices, acute care, long-term illness, and physical parameters (e.g., blood pressure). Of the categories reviewed, only compliance and long-term conditions showed consistent findings across studies. Particularly, external HLOC was positively correlated with having a long-term illness, suggesting that the existence of illness may have influenced HLOC over time. Additionally, external HLOC was positively correlated with compliance, not supporting previous hypotheses that external HLOC correlates with less active health behavior. These results mirror those mentioned by Wallston and Wallston (1982) in which individuals with powerful others HLOC were more adherent to treatment recommendations than those with internal HLOC.

The review cited research methodology as limiting the ability to make clear conclusions regarding the relationship between HLOC and other factors (Oberle, 1991). Specifically, most studies conducted cross-sectional correlations, preventing conclusions of causality, and many failed to consider HLOC as a multi-dimensional construct. The author concluded that “the collective results of this research have yielded little information that is useful for nursing practice” (p. 800). AbuSabha and Achterberg (1997) reviewed research examining the influence of self-efficacy and LOC on nutrition- and health-related behavior, and they found similarly inconclusive results across studies. They mentioned that locus of control, when used alone, has a small influence on health behavior, and they emphasized the need for including other constructs when predicting health behavior.

Park and Gaffey (2007) reviewed research investigating the relationship between psychosocial factors and health behaviors in cancer survivors. With regard to health locus of control, they found that several studies demonstrated a positive association between IHLC and healthy behaviors such as diet and exercise in cancer survivors. They also reviewed a study that linked higher PHLC to a lower likelihood of increased exercise. They noted, however, that the link between HLOC and positive health behaviors was inconsistent across studies with regard to exercise, alcohol use, and smoking behavior. Notably, none of the studies covered in the three aforementioned reviews focused on back pain patients.

Additional researchers have studied the relationship between HLOC (as measured by the MHLC) and various psychological and behavioral outcome measures in recent years, although this research typically has not focused on back pain patients. For example, Bonetti and colleagues (2001) examined the relationship between HLOC and mental and physical health in 106 healthy college students and 145 patients with rheumatoid arthritis, multiple sclerosis, or history of stroke. They found IHLC was positively correlated with students' activity levels, and CHLC was positively correlated with patients' and students' anxiety levels. O'Carroll et al. (2001) studied 72 patients who had experienced myocardial infarction, and found higher levels of CHLC were correlated with delayed response in seeking medical help after the myocardial infarction. The results of these two studies support correlations, in populations other than back pain patients, between IHLC and positive health behaviors, between CHLC and mental distress, and between CHLC and delayed health behaviors.

In another study, Pucheu and colleagues (2004) evaluated the relationship between HLOC and quality of life (QOL) in 47 peritoneal dialysis patients, and found the physical component scale of their QOL measure was positively correlated with IHLC and negatively correlated with PHLC. Their findings offer additional support that external (powerful others) control expectancies are correlated with higher levels of distress, while internal control expectancies are related to less distress. Although the above studies (i.e., Bonetti et al., 2001; O'Carroll et al., 2001; Pucheu et al., 2004) did not include back pain patients, they suggest potential relationships between HLOC and psychological and behavioral outcomes. However, the cross-sectional nature of their correlational analyses precludes the ability to make causal inferences about these relationships.

Researchers have also examined the relationship between HLOC and physical well-being. Conant (1998) examined the relationship between HLOC and pain perceptions in 103 individuals who had experienced spinal cord injury at least one year prior to participation and had subsequently developed chronic pain. Results indicated that IHLC was negatively correlated with self-report of pain perceptions, i.e., those with internal control expectancies reported less pain, although this study's correlational data prevent the determination of causality.

In a longitudinal study, Adams, Mannion, and Dolan (1999) examined risk factors for first-time development of back pain in 403 healthcare workers, ages 18-40 years, with no history of "serious" back pain. They administered the MHLC at baseline with other physical and psychological measures, and gathered information about back pain occurrence along with the physical and psychological measures up to 36 months following baseline measurement. IHLC and PHLC subscales of the MHLC did not consistently predict the occurrence of serious back pain or any back pain. CHLC predicted the occurrence of severe back pain reported at 12 months but not 36 months. Therefore, in a study with potential to elucidate predictive relationships between HLOC and physical outcomes, chance expectancies appeared inconsistently predictive of subsequent pain. While the results of these two studies support that internal expectancies coincide with less pain and that external (chance) expectancies coincide with more pain, the findings do not lead to consistent conclusions regarding the causal relationship between HLOC and the occurrence of pain.

The research reviewed thus far offers a wealth of information regarding the correlates of HLOC for a variety of patient populations. To summarize, research has shown that higher IHLC correlates with higher life satisfaction, stronger will to live, more desire for control over the healthcare delivery process, increased information-seeking behaviors in relation to healthcare, more adherence to health recommendations, increased activity level, improved diet, better physically-based quality of life, and lower self-report of physical symptoms. Research has demonstrated that higher PHLC correlates with increased information-seeking, higher adherence to medical recommendations, lower likelihood of increasing exercise, decreased desire for control over the healthcare delivery process, and lower physically-based quality of life. Studies have indicated that higher CHLC correlates with increased depression and anxiety, higher report of physical symptoms, lower desire for control over the healthcare delivery process, and delayed response in seeking medical care.

Overall, these results imply that more internal expectancies of the ability to impact health outcomes are associated with better physical and mental well-being as well as more proactive health behaviors. In contrast increased belief that outcomes are due to chance is associated with decreased physical and mental well-being and less proactive health behaviors. Individuals who believe powerful others have high impact on their health appear to leave control over their healthcare delivery to the healthcare professionals involved in their care, seeking and adhering strongly to medical recommendations, and they are more likely to have chronic pain or disability. These findings regarding IHLC, CHLC, and PHLC offer theoretical support for the locus of control construct in patient populations, with higher IHLC predicting improved outcomes as compared to CHLC and PHLC. However, these studies did not focus on back pain patients. Research specifically with a chronic pain population has indicated that higher IHLC correlates with decreased self-report of pain perceptions (Conant, 1998), and that higher CHLC correlates with increased likelihood of developing severe back pain, although this finding was inconsistent over time (Adams, Mannion, and Dolan, 1999).

While the extant research on HLOC in the back pain population further supports theoretical predictions of the construct, that is, decreased pain for those with higher IHLC and increased pain for those with higher CHLC, the limited number of studies focusing on back pain patients warrants more examination of the HLOC construct with this population. Additionally, the cross-sectional nature of these correlations calls for additional analyses, including a predictive component, to determine causality. It is not possible to determine from these studies whether IHLC leads to improved health outcomes or vice-versa, or whether an unknown variable leads to changes in both. It is possible that patients with less severe symptoms or more ability to seek services and participate in treatment are more likely than others to believe their actions make a difference in managing their pain. It is also possible a third variable, such as psychological well-being, leads to internal expectancies of control as well better physical and mental well-being. Similarly, it is not possible to determine whether CHLC and PHLC directly cause or result from correlated factors, or whether an unknown variable leads to the changes in both. Finally, it must be emphasized that many of the findings correlating HLOC to various outcome measures have led to inconsistent results across studies, weakening the strength of support for the HLOC construct.

While the aforementioned studies support the idea that internal control expectancies are related to better physical, psychological, and behavioral outcomes than external expectancies, the data do not clearly indicate a causal relationship in which internal expectancies lead to better outcomes than external expectancies. Furthermore, inconsistencies in the results across studies, and low number of studies specifically examining back pain patients, warrant further investigation of the relationship between HLOC and physical and mental well-being in back pain patients. Wallston and Wallston (1982) discussed the potential utility of predicting health outcomes using the MHLC scales. They mentioned that many health interventions emphasize patient responsibility and internal locus of control, which could logically lead individuals with more internal expectations of control over their health to gain more benefit than others. Accordingly, further research may allow a determination of whether back pain patients with more internal control expectancies benefit more from treatment than those with more external control expectancies.

Altering HLOC

While discussion thus far has focused on the utility of predicting outcomes based on individuals' control expectancies, it is important to mention that it may be possible to change HLOC expectancies during treatment. Wallston and Wallston (1982) suggested that tailoring intervention to locus of control expectancies may improve quality of care, and they noted that some studies had demonstrated the ability to change locus of control through intervention. More recently, Rybarczyk, DeMarco, DeLaCruz, Lapidos, & Fortner (2001) demonstrated the ability of an intervention to change HLOC beliefs. They compared physical and psychological outcomes (including HLOC as an outcome measure) in a group receiving a mind-body wellness intervention to outcomes in a control group. All participants had a chronic illness (hypertension, diabetes, osteoarthritis/rheumatoid arthritis, cardiovascular disease, spinal stenosis/low back pain, or hypercholesterolemia), had 6 or more primary care visits in the preceding year, and were over 50 years old. The intervention group attended eight 2-hour classes consisting of psychoeducation, relaxation training, cognitive and behavioral interventions, exercise training, and nutrition education. The intervention group demonstrated decreased CHLC and PHLC up to 1 year post-treatment. Although the study included randomization into intervention and control groups, the control group did not receive any intervention, merely completing questionnaires when intervention participants completed them. Therefore, although the results indicate that external locus of control beliefs can be changed through intervention, conclusions about which aspect(s) of the program led to decreased external locus of control are not possible.

Inclusion of Additional Constructs

As discussed thus far, a wealth of research has examined the locus of control construct in patient populations, in relation to its predictive value as well as its ability to be changed through treatment. In terms of predicting outcome for back pain patients receiving intervention, it has become more evident over time that examining HLOC alone offers only a small piece of the picture. The developers of the MHLC scales have emphasized the importance of assessing the influence of other variables in addition to locus of control when attempting to determine the potential for health behavior to occur (Wallston, 1991). Wallston noted that researchers often fail to measure other variables, such as health value and self-efficacy, and have had difficulty predicting health behavior using the MHLC alone. Using the original development of the locus of control construct within Social Learning Theory, the potential for a behavior to occur depends on both the expectancy that reinforcement will result from the behavior, and the value of the given reinforcement (Rotter, 1982). According to Social Cognitive Theory (Bandura, 1997), behavior potential also varies depending on an individual's perception of her or his ability to perform the behavior. To facilitate better predictions of health behavior, Wallston (1991) encouraged measurement of health value or, in cases in which individuals have pre-existing medical conditions, disease severity, and self-efficacy in addition to MHLC. Luszczynska and Schwarzer (2005) argued that other constructs such as self-efficacy may be even stronger predictors of health behavior change than HLOC. It appears important to consider other contributing factors, such as self-efficacy, when attempting to predict health behavior using the locus of control construct.

The research discussed thus far suggests that we may expect back pain patients with high IHLC to benefit from MI more than those with high CHLC, DHLC, or OHLC. This expectation is based on the requirement within MI that patients participate actively in their rehabilitation across multiple modalities within MI treatment. Accordingly, those who perceive their behavior as directly related to improved pain may be expected to engage more in treatment that requires pain management behavior on the part of patients (as opposed to purely external intervention). Unfortunately, these predictions are based on inconsistent findings from studies focusing primarily on populations other than back pain patients. Furthermore, researchers have suggested HLOC alone offers little predictive value, emphasizing the need to include additional constructs such as self-efficacy (e.g., Wallston, 1991; Luszczynska & Schwarzer, 2005). Theoretically, we may expect individuals with IHLC to benefit more from treatment when they also feel efficacious in carrying out the required behaviors over which they believe they have control. This possibility calls for a review of the possible correlates of self-efficacy in back pain patients.

Self-Efficacy

Bandura (1986) developed the self-efficacy construct as part of Social Cognitive Theory (SCT). According to SCT, self-efficacy is an important cognitive factor referring to "people's judgments of their capabilities to deal effectively with different realities" (Bandura, 1986, p. 21). Higher levels of self-efficacy theoretically increase the likelihood of attempting a particular behavior, and may increase effort placed into each subskill of a behavior. An individual's belief that he or she is capable of performing an action increases the likelihood of performing the action. Therefore, if an individual does not believe he or she can successfully engage in a required behavior (i.e., self-efficacy is low), the likelihood of expending energy to attempt the behavior is low.

Self-efficacy beliefs are formed based on previous experiences in a given situation, experiences in similar situations, and experiences with performing required subskills of a task (Bandura, 1997). For example, an individual's self-efficacy for obtaining an "A" on an exam may be influenced by previous ability to obtain high grades in the current subject area, previous ability to obtain high grades in similar subject areas, and previous experiences with component behaviors, such as studying efficiently, retaining information, and performing well with the required exam format. The combination of previous experiences contributes to one's self-efficacy for the overarching behavior of obtaining an "A" on an exam. Notably, Bandura (1997) noted that specific efficacy for attaining the high grade contributes to behavior more strongly than efficacy for subskills such as studying, retaining information, and answering multiple choice questions. In other words, "the whole is greater than the sum of its parts" (Bandura, 1997; p. 38). It is important to note that the behaviors combining to form the overarching behavior may not be apparent despite their contribution to self-efficacy. For instance, an individual's self-efficacy for obtaining an "A" on an exam may be, in part, influenced by perceived ability to read and write quickly, or perceived ability to "sense" the correct answer on a multiple choice exam, and numerous other idiosyncratic factors.

It is important to distinguish between the HLOC and self-efficacy constructs. Perceived self-efficacy concerns the belief that one is capable of performing a behavior or a collection of required subskills. Locus of control concerns an individual's belief that his or her behavior directly elicits a desired reinforcement. For example, an individual's belief in the ability to perform all necessary behaviors leading to obtaining an "A" on an exam is his or her perceived self-efficacy. The belief that performing particular behaviors such as studying will actually result in the "A," as opposed to other factors such as generosity of the professor determining the grade, indicates the level of internal versus external locus of control for obtaining an "A." These factors together may predict an individual's likelihood of performing a particular behavior (Wallston, 1991; Bonetti et al., 2001). Therefore, an individual's likelihood of studying for an exam is predicted both by the belief that he or she can successfully study (high perceived self-efficacy) and the belief that studying will directly contribute to receiving a high grade (internal locus of control). Translating the application of these constructs to pain behaviors, the likelihood of engaging in a particular pain-management behavior, such as daily exercise, would be influenced by an individual's belief in his or her ability to exercise daily and his or her belief that daily exercise directly contributes to pain reduction.

Bandura (1997) defined perceived self-efficacy, outlined a number of factors influencing and influenced by self-efficacy, and described appropriate methods for measuring self-efficacy in research and clinical settings. Specifically, perceived self-efficacy describes "a belief about what one can do under different sets of conditions with whatever skills one possesses" (Bandura, 1997, p. 37). Perceived self-efficacy is influenced by experience and reflective thought about the ability to perform required subskills of a behavior. Perceived self-efficacy has been found predictive of academic performance, proneness to anxiety, pain tolerance, metabolic control in diabetes, political participation, use of preventative dental practices, improved pulmonary functioning, effective breast self-examination, healthful nutritional and exercise habits, seeking smoking treatment, and long-term smoking cessation (Bandura, 1997). Perceived self-efficacy has also been found to predict treatment outcomes in pain patients, such as performance of physical tasks, increased exercise during treatment, reduced medication use, return-to-work, and improved pain, disability, and mood (Turk & Okifuji, 2002).

Self-efficacy and back pain

A wealth of research has examined self-efficacy in relation to back pain. Previous authors have discussed possible mechanisms underlying the effect of self-efficacy on back pain (Lin & Ward, 1996). First, high self-efficacy may lead to decreased pain due to increased likelihood of utilizing available coping skills for lowering pain; second, high self-efficacy may lead to more perseverance in pain-reduction efforts than found in individuals with low self-efficacy; and third, high self-efficacy may reduce physiological arousal and body tension, which increase pain. Research has supported the hypothesis that self-efficacy impacts back pain through the tendency to persevere with pain-reduction efforts (Lin & Ward, 1996). Pain-related self-efficacy has been measured with a variety of instruments, ranging in specificity. Considering the range of specificity of these instruments, the scope of studies examining self-efficacy in back pain patients includes measures of general self-efficacy, measures of health-related self-efficacy, and measures pain-specific self-efficacy. Taking into account Bandura's (1997) suggestions, a self-efficacy instrument should include items particularized to the behavior in question to offer predictive value. In other words, if a researcher would like to use a self-efficacy measure to predict pain behavior, the self-efficacy instrument should measure patients' self-efficacy for behaviors specifically relevant to managing their pain. Therefore, in examining the correlates of self-efficacy in back pain patients, the following section will describe in detail only those studies using measures of *pain-related* self-efficacy.

Altmaier et al. (1993) examined the role of self-efficacy beliefs in outcomes of a 3-week back pain rehabilitation program. Specifically, they investigated the impact of treatment-related improvement in self-efficacy on functional disability and pain level. They constructed a measure of self-efficacy that focused on self-rated ability to perform activities of daily living, despite pain. Participants were 45 back pain patients, ages 25 to 58, enrolled in a 3-week rehabilitation program. Treatment occurred in a group format, with 4 to 6 patients per group. Twenty-one patients received standard rehabilitation, that is, education and physical therapy, while 24 received standard rehabilitation plus counseling and coping skills interventions. They completed follow-up questionnaires 6 months following treatment. Improved self-efficacy did not predict changes in pain and functioning at the time of discharge from the program. However, increased self-efficacy from admission to discharge predicted maintenance of benefits 6 months following treatment. Although numbers were low, the longitudinal nature of data collection supports the predictive nature of self-efficacy on pain and functioning as it relates to back pain.

Self-efficacy also demonstrated a relationship with performance on functional capacity evaluations in a separate study (Kaplan et al., 1996). In this study, 64 patients with low back pain rated their self-efficacy by completing four items assessing their predicted performance on the functional capacity evaluation. Patients determined to exert submaximal effort on the evaluation demonstrated lower self-efficacy than those determined to exert maximal effort. The results indicated that those exerting more effort tended to have higher self-efficacy than those exerting less effort. This relationship between higher self-efficacy and increased effort aligns with the theoretical notion that higher self-efficacy leads to more willingness to attempt a behavior. However, due to an inability to experimentally control self-efficacy, it is not possible to determine the causal relationship between self-efficacy and level of effort in these analyses.

Another study further supported the relationship between self-efficacy and functioning, using an isokinetic trunk muscle test (Estlander et al., 1994). One hundred and five patients with recurrent or persistent low back pain completed questionnaires and completed isokinetic testing, requiring various flexion and extension movements of the back for varied lengths of time. Regression analyses supported the conclusion that higher self-efficacy was associated with improved performance beyond the effects of pain and disability, discounting the possibility that self-efficacy and function were related to each other solely due to their relation to pain and disability. In other words, it did not appear that pain and disability level led to lower self-efficacy and lower functioning without a direct relationship between self-efficacy and functioning. Therefore, higher self-efficacy and improved performance appeared to have a direct association.

A similar study found only low to moderate correlations between self-efficacy and measures of physical performance functioning (loaded reach, sit to stand, walking, rolling side to side) in 51 patients with chronic low back pain (Cunha, Simmonds, Protas, & Jones, 2002). Both studies utilized an 8-item measure of self-efficacy, in which participants reported how long they could sustain the following categories of activity: bicycling, walking, running, carrying weights, sitting in an armchair, standing, sitting at a desk, and working while leaning forward. It is unclear what led to the differing results between the two studies, that is, stronger correlation between self-efficacy and physical functioning in the Estlander et al. (1994) study than in the Cunha et al. study. One possible factor contributing to the differential results is the difference in types of physical activity tested. Overall, the results suggest a possible relationship between higher self-efficacy and improved performance on physical tasks, more specifically tasks targeting the back muscles.

Lackner and Carosella (1999) investigated the contributions of lifting performance self-efficacy, perceived pain control, and anxiety on actual lifting performance. One hundred work-disabled patients completed psychological questionnaires several days before completing physical and functional evaluations. Functional self-efficacy was measured using the Functional Self Efficacy scales, consisting of a list of 33 physical requirements of work identified by the United States Department of Labor as important for ability-requirement match within the workplace. Correlational analyses indicated higher functional self-efficacy was related to better lifting capabilities. In a similar study including 85 participants with chronic lower back pain, Lackner, Carosella, and Feuerstein (1996) found that functional self-efficacy was correlated with physical function above and beyond participants' expectancies that physical activity would cause injury or pain. These studies offer further support for a relationship between higher self-efficacy and better physical functioning in individuals with back pain. Due to the correlational relationship of the results in both studies, it is not possible to make causal inferences about this association.

Brox and colleagues (2005) examined the relationships between psychological factors (fear avoidance, self-efficacy, emotional distress, and life satisfaction), disability, pain, and physical performance in 45 participants who were healthy, 46 who had sub-acute low back pain, and 45 who had chronic low back pain. Correlational analyses indicated lower self-efficacy in patients with chronic low back pain than in those with subacute back pain. The cross-sectional nature of these correlational analyses precludes causal inferences; therefore, it is not clear whether chronic back pain leads to decreased self-efficacy or vice-versa. The results offer further support that higher self-efficacy is associated with decreased duration of pain.

A recent study demonstrated a positive relationship between self-efficacy for lifting or carrying and scores on a functional capacity evaluation (Renemen, Geertzen, Groothoff, & Brouwer, 2008). They assessed self-efficacy in 92 adults with nonspecific chronic low back pain referred to an outpatient multidisciplinary pain management program. To assess specific self-efficacy, researchers asked participants how much weight they expected to lift or carry immediately before a functional capacity evaluation was performed. They found that higher self-efficacy was moderately positively correlated with more weight lifted at a low height, but not correlated with amount of weight carried or amount lifted overhead. Their results provide mixed results with regard to the relationship between pain-related self-efficacy and functional capacity, which may be in part due to the use of only one question as the measure of self-efficacy. Again, due to the correlational nature of the analyses, causal direction may not be inferred from these results.

To summarize the above research on self-efficacy, higher self-efficacy in pain patients has been found correlated with better performance on physical tasks, more exercise during treatment, lower medication use, increased likelihood of return-to-work, decreased pain, decreased disability, and improved mood. In patients with back pain, higher self-efficacy has been shown to correlate with more maintenance of treatment benefits, more effort in functional capacity evaluations, better performance on isokinetic testing, increased lifting capabilities, better physical functioning, and shorter duration of back pain. The above research consistently demonstrates a correlation between self-efficacy and pain outcomes in the direction predicted by SCT (Bandura, 1986). That is, higher levels of self-efficacy are correlated with more effort during treatment and better physical and mental treatment outcomes. However, only one study (Altmaier et al., 1993) offers predictive information to suggest level of self-efficacy precedes the associated outcomes, while the other studies offer cross-sectional correlational data. Therefore, it is possible that pain levels influence self-efficacy, or an unknown factor leads to changes in both. Further research is required to corroborate the predictive nature of self-efficacy in chronic back pain treatment outcomes.

Altering self-efficacy

The research cited above lends consistent support for the correlation of high self-efficacy to positive outcomes in back pain patients. Therefore, self-efficacy may be useful as a predictor of treatment outcome. Similar to the HLOC construct, it may also be beneficial to specifically target self-efficacy with back pain interventions. Numerous research studies have demonstrated the ability of treatment to increase self-efficacy. One study found increased self-efficacy lasting up to 3 months following treatment in 38 individuals with non-specific low back pain who received either general exercise instruction or exercise instruction with stabilization enhancement components (Koumantakis, Watson, & Oldham, 2005). Other research studies have offered support for the differential impact of various treatment components on self-efficacy changes. Nicholas, Wilson, and Goyen (1992) compared a cognitive-behavioral group treatment, including relaxation training, physiotherapy, and back education, to a similar control treatment without cognitive-behavioral and relaxation components. Eighteen total patients with chronic low back pain participated in one of the two treatments. Those who received the cognitive-behavioral treatment experienced more increase in self-efficacy than the control group by the end of treatment. Univariate analyses indicated this difference remained at 6 months, but the significance was not present in multivariate analyses. Although the number of participants was low, the results indicate cognitive-behavioral interventions may offer increased self-efficacy above and beyond the impact of physiotherapy and attention from a group facilitator alone.

Similarly, Kool et al. (2005) conducted a randomized controlled trial to compare pain-centered versus function-centered treatment in multidisciplinary rehabilitation programs. The programs offered similar interventions; however, in the pain-centered program, individuals were told to stop activity when pain increased, whereas individuals in the function-centered program were encouraged to continue activity regardless of pain. Participants included 174 patients with nonacute non-specific low back pain. Individuals in the function-centered treatment program exhibited greater increase in pain-related self-efficacy than those in the pain-centered program. These results suggest treatment focused on increasing activity regardless of pain may be an important feature of programs intending to increase pain-related self-efficacy.

A recent study demonstrated a correlation between change in pain-related self-efficacy and change in muscle strength through medical or cognitive and physical intervention delivered to individuals with back pain who had recently experienced spinal fusion surgery (Keller, Brox, & Reikerås, 2008). Participants consisted of 124 adults with chronic low back pain who either received three weeks of cognitive and physical therapy across a five-week period, or who received lumbar spinal fusion. Individuals' change in self-efficacy was significantly correlated with change in muscle strength, i.e., increased self-efficacy across time was related to improved muscle strength over time. Regression analyses, however, showed that change in self-efficacy was not a significant predictor when placed in a model with change in pain and type of treatment. These results indicate that change in self-efficacy may not only be a relevant outcome but also a relevant predictor of other outcomes following intervention for chronic back pain, although correlational analyses preclude a directional interpretation of their results.

The literature clearly supports a relationship between self-efficacy and physical outcomes. Altmaier et al.'s (1993) study implies higher self-efficacy may predict better outcomes in a multidisciplinary treatment for chronic back pain. Other studies indicate a correlation between high self-efficacy and better treatment outcomes, precluding causal inferences. Additionally, many studies indicate that intervention can alter self-efficacy, further blurring the causal inferences that can be made regarding the relationship between self-efficacy and treatment outcomes. A number of possible hypotheses arise based on these studies.

One hypothesis is that individuals with higher pain-related self-efficacy would benefit more from treatment than individuals with lower self-efficacy, implying it may be beneficial to screen for self-efficacy when determining whether a given individual should receive intensive treatment. Another hypothesis is that those who benefit from treatment will achieve increased self-efficacy, and individuals who experience worsening in pain levels will experience decreased self-efficacy. A third possibility is that a third variable, such as physical functioning, leads to changes in self-efficacy and treatment outcomes. Based on the study by Estlander et al. (1994), pain and disability level do not cause the relationship between self-efficacy and physical functioning; however another unknown variable, such as anxiety or depression, may drive this relationship. It is important that future research attempt to address the relationship between self-efficacy and treatment outcome using analyses that can offer predictive information about self-efficacy as it affects treatment outcomes for chronic back pain.

Multidisciplinary Intervention for Back Pain

Multidisciplinary intervention (MI) for back pain is often the final recommendation for individuals who have received multiple other interventions with little improvement. MI typically includes a combination of physical intervention with social, psychological, and/or occupational interventions (Guzmán et al., 2001). MI may include, but is not limited to, any combination of the following: stretching, weight training, aerobics, water exercises, recreation/sports, massage, injections, ice/heat application, transcutaneous electrical nerve stimulation, occupational task simulation, cognitive behavioral or behavioral groups, back care education, psychoeducation, postural training, relaxation training, biofeedback, counseling, coping group discussions, consultation for work problems, courses on job seeking, meeting with employers, and meeting with relatives (Guzmán et al., 2001). As mentioned previously in this manuscript, MI may or may not be interdisciplinary in nature, with interdisciplinary implying collaboration between disciplines on the treatment team. Therefore, MI for back pain encompasses a wide variety of interventions and treatment philosophies.

Research on the use of MI for chronic back pain suggests overall treatment efficacy, including long-term gains, but the evidence is inconsistent, especially when considering financial cost. Guzmán et al. (2001) systematically reviewed ten randomized controlled trials that took place from 1989 to 1997 comparing multidisciplinary intervention (physical plus at least one of social, psychological or occupational) to a control treatment for individuals with disabling low back pain. The ten trials included 1964 individuals with disabling low back pain. Results indicated that intensive daily MI totaling over 100 hours of intervention using a functional restoration approach led to more improvement in pain and function than control treatments. Less intensive programs did not lead to significantly better improvements than the control treatments. No programs reported consistently reducing sick leave days. Therefore, despite the clear indication that MI improved pain and function, the authors noted that the determination of whether intensive MI programs were worth their financial cost was up for debate.

A systematic review of randomized, controlled trials investigated the effectiveness of multidisciplinary intervention for chronic pain (Scascighini, Toma, Dober-Spielmann, & Sprott, 2008). The review included studies comparing multidisciplinary treatment for chronic nonspecific musculoskeletal pain to wait-list control, treatment as usual, or control-group treatment such as patient education. The researchers also compared outcomes for inpatient, intensive treatment versus outpatient and treatment for differing pain diagnoses. Their review included 27 studies, for a total of 2407 patients. Of the 15 studies comparing MI to wait-list controls or treatment as usual, 13 offered strong support for the superior effectiveness of MI, while 2 of the studies did not demonstrate higher benefit from MI. Their review of 15 studies comparing MI to alternative treatment demonstrated moderate evidence for the increased benefit of MI versus non-multidisciplinary treatments, as 5 of the studies demonstrated no significant difference. In comparisons between intensive inpatient programs and low-intensity outpatient treatment, four studies demonstrated superiority of the inpatient programs and one demonstrated no difference. Comparisons between types of pain diagnosis indicated that MI treatment is more beneficial for patients with chronic back pain or fibromyalgia than other nonspecific chronic pain groups.

One study examined the relationship between HLOC beliefs and outcome in a MI for low back pain (Härkäpää, Järvikoski, Mellin, Hurri, & Luoma, 1991). Their selection methods produced a participant population consisting of employed individuals with low back pain. They compared a 3-week MI for inpatients to a 15-session outpatient treatment and a control treatment. They found that the two treatment groups demonstrated significantly greater decrease in disability as compared to the control group; significantly more inpatients than controls experienced at least a 5-point decrease in a low back pain disability index; and inpatients performed their exercises significantly more than outpatients and controls at 3-month follow-up. Belief in control by others (PHLC) was significantly associated with less exercise at follow-up across treatment groups. Notably, this study randomized individuals into treatment conditions, allowing for clear measurement of the efficacy of the MI program.

Results from additional studies, utilizing a variety of treatment outcome measures, have offered inconsistent evidence for the efficacy of MI for chronic back pain. One study compared MI in an outpatient setting, including four days of intensive education and regular follow-up appointments, to treatment in a private practice setting by individual physicians (Claiborne, Vandenburgh, Krause, & Leung, 2002). Due to significant baseline differences between the two groups, the authors did not statistically compare the groups post-treatment. However, they highlighted the fact that patients in the back program demonstrated improvements in physical quality of life despite matching the profile of patients predicted in the literature to have poor outcomes, i.e., those with elevated risk for having chronic disabling back conditions. They concluded the back education program was probably effective in improving physical quality of life.

Another study examined differences between MI and a wait-list control group who were free to seek outside services (Vollenbroek-Hutten et al., 2004). Participants were 142 patients with chronic, nonspecific low back pain. The MI group received seven weeks of treatment including weekly conditional training and sport, swimming, occupational therapy, and physiotherapy, and as-needed services from a dietician and psychologist. The control group was informed they could receive MI treatment after the six month follow-up period. Results indicated no differences between the treatment and control groups on primary outcome measures of level of disability and quality of life at six month follow-up. Additionally, no differences existed in level of psychological dysfunction. However, the treatment group demonstrated higher likelihood of experiencing clinically relevant changes on physical condition and kinesiophobia (fear of movement) than the control group, from baseline to follow-up. This study offered support for the efficacy of MI as compared to a wait-list control condition in terms of physical condition and fear of movement, but not when considering the primary measures for disability, quality of life, and psychological dysfunction. Authors noted the primary outcome measures may have lacked sensitivity necessary to detect significant differences. Therefore, the results based on appropriately sensitive measures in this study indicate MI is more beneficial than a wait-list control.

Another study offered evidence that MI is more beneficial than a no-treatment control condition (Spinhoven et al., 2004). The MI treatment groups demonstrated greater increase in internal pain control expectancies, greater decrease in external pain control expectancies, and greater decrease in catastrophizing than the control group immediately following treatment. The differential decreases in external control expectancies and catastrophizing remained at 12 month follow-up. However, treatment did not enhance coping, a primary outcome measure, more than the control condition. Multidisciplinary intervention appeared to have some advantages to a wait-list control condition, but the overall results of this study were equivocal with regard to the efficacy of MI for chronic back pain.

A different study compared MI group treatment to individual therapy for 113 individuals with chronic pain, the majority having spine pain (Turner-Stokes et al., 2003). They found the two treatment programs, both utilizing cognitive-behavioral therapy, equally effective for the outcomes of pain interference, control over pain, depression, anxiety, medication consumption, activity level, and pain severity. Furthermore, the MI was more expensive per-person than the individual program, due to drop-out of group members. These results did not support higher efficacy or reduced cost-effectiveness of MI versus individual treatment.

Norlund, Ropponen, and Alexanderson (2009) conducted a meta-analytic review of randomized, controlled trials examining the efficacy of MI on return to work in comparison to a control group (which was not defined for all studies). Their review included seven studies and a total of 1450 patients with low back pain that had lasted over four weeks who were on sick leave from work. They conducted meta-analysis in two steps, first including all seven studies they reviewed and then including only studies conducted in Scandinavia. The first meta-analyses suggested a publication bias effect, although they noted that individuals who had been out of work 5 to 11 weeks benefited somewhat more from MI than alternative treatments. When only Scandinavian groups were included, the meta-analysis did not demonstrate publication bias. This second meta-analyses indicated a clinically relevant difference between patients who received MI and those in the control group. The researchers concluded that the limited effect found across studies, in combination with possible publication bias, generate uncertainty about the efficacy of MI on return to work in patients with low back pain.

As listed above, a number of studies have offered mixed support for MI utilizing a heterogeneous collection of outcome measures, some of which may lack the required sensitivity to detect treatment group differences. Other studies have offered evidence of the long-term efficacy of MI for chronic back pain, with impressive outcomes. For example, one study examined 175 patients with chronic low back pain who experienced a back school program utilizing MI (Shirado et al., 2005). Eighty percent of patients experienced pain reduction immediately following treatment. Analyses examining this group of patients demonstrated increased pain relief and functional status at 12 month follow-up. They also demonstrated improvement in flexibility as measured by finger-floor distance. Although the study did not include a control group, the pain reduction scores were comparable to those found in other studies in the literature showing positive outcome (Shirado et al., 2005).

Patrick, Altmaier, and Found (2004) examined long-term results of a MI program for low back pain over 13 years post-treatment, demonstrating the long-term gains of MI. While their study did not include a comparison control group, they found that individuals who had received MI did not differ significantly from similarly aged comparisons in the population at large, in terms of general health. Furthermore, the interference of their pain was significantly lower than at the original pretreatment and posttreatment assessments. They also exhibited a significant decrease in pain intensity and mood disturbance as compared to the initial posttreatment assessment. Although having no comparison group of untreated individuals limited the interpretation of the findings, the authors emphasized the potential cost-effectiveness of utilizing such interventions that lead to long-term positive outcomes for individuals with back pain.

Summary and Conclusions

Health locus of control (HLOC) refers to expectancies of whether one's health is controlled by internal or external factors. As mentioned previously, individuals with a more internal HLOC are likely to perceive a causal relationship between their health behaviors and health outcomes, while those with a more external HLOC are likely to perceive health outcomes as primarily influenced by factors such as chance, luck, fate, or powerful others (Wallston & Wallston, 1982). Alternatively, pain-related self-efficacy refers to the belief that one is capable of performing behaviors expected to decrease pain. Individuals with higher pain-related self-efficacy are likely to feel competent in performing behaviors recommended as part of pain-related intervention (Bandura, 1997). These constructs offer helpful information regarding health behaviors and, therefore, potential for benefit from medical treatment.

Multidisciplinary intervention (MI) has demonstrated efficacy, albeit inconsistently, for the treatment of chronic back pain (e.g., Guzmán et al., 2001; Härkäpää et al., 1991; Claiborne et al., 2002), and is often the last resort for individuals with chronic back pain (Guzmán et al., 2001). The increasing popularity of MI programs, in addition to the reliance on such programs for treating those with pain that has not responded well to other treatment, make it especially important to understand predictors of treatment outcome for MI programs. The structure of MI for chronic back pain typically requires significant changes to health behaviors, such as increased exercise, change in diet, frequent stretching, and increased use of psychological pain management strategies such as relaxation. Therefore, one might expect that individuals who perceive their health behaviors as directly influencing their health outcomes (i.e., those with a more internal HLOC) would be more likely to make the changes recommended within MI for their back pain (Wallston & Wallston, 1982; Härkäpää, Järvikoski, Mellin, Hurri, & Luoma, 1991). Furthermore, one might expect individuals who feel competent in performing recommended health behaviors (i.e., those with high pain-related self-efficacy) would be more likely to attempt the changes recommended within MI for their back pain.

As expected, research has demonstrated that internal expectancies of control are related to less pain and more proactive health behaviors than external expectancies of control (e.g., Wallston & Wallston, 1982). Research has also demonstrated that higher self-efficacy is related to less pain, higher functioning, better treatment outcomes, and more proactive health behaviors (e.g., Altmaier et al., 1993; Turk & Okifuji, 2002). While numerous studies have examined HLOC and pain-related self-efficacy separately, research has not examined the effects of both variables in chronic back pain patients. To the knowledge of this author, one research study has been published that examined the interaction of HLOC and self-efficacy in predicting a health outcome, that is, glycosylated hemoglobin (HbA1c) levels in individuals with type 2 (adult-onset) diabetes (O'Hea et al., 2009). Level of HbA1c served in this study to indicate gradation of adherence to medical regimen, with lower HbA1c indicating better glycemic control. This study invested the three-way interaction between HLOC, self-efficacy, and outcome expectancies in predicting HbA1c levels. Results indicated that internal HLOC did not demonstrate a notable relationship to HbA1c levels when self-efficacy was high. When self-efficacy and outcome expectancies were both low, higher internal HLOC was predictive of lower levels of HbA1c. When patients demonstrated a combination of low self-efficacy and high outcome expectancies, however, higher internal HLOC was related to higher levels of HbA1c levels, indicating poorer glycemic control. Although the inclusion of the outcome expectancies variable provided increased complexity in understanding the relationship between self-efficacy and HLOC, it is notable that HLOC was not helpful in predicting of glycemic control when self-efficacy was high.

Based on extant research in the area, it is not clear how HLOC and self-efficacy might together predict treatment outcomes in a MI program for chronic back pain. Based on the theoretical constructs of HLOC and self-efficacy and what research has already shown, it is possible to make some hypotheses regarding their potential effects on treatment outcome.

Theoretically, one might predict that maximum treatment benefit would arise in individuals with high IHLC, low CHLC, OHLC, and DHLC, and high pain-related self-efficacy. It is likely that lower CHLC, DHLC, and OHLC, in combination with high IHLC and high self-efficacy, would be more adaptive than high DHLC, OHLC and/or CHLC, based on the studies demonstrating a correlation between higher external HLOC and increased likelihood of having chronic pain and/or disability (Wallston & Wallston, 1982).

To illustrate the potential effects of self-efficacy and HLOC, consider an individual with high pain-related self-efficacy, low IHLC and high CHLC, DHLC, and

OHLC. In this individual, high pain-related self-efficacy would translate to confidence in his or her ability to perform certain tasks recommended for pain management. Low IHLC would translate to low expectancy that performing certain tasks would lead to the desired reinforcement, pain reduction. High CHLC, DHLC, and OHLC would translate to a belief that external factors, medical professionals, and others control his or her pain. This individual would feel his or her own actions would not impact pain levels. In sum, this individual would have a strong belief that he or she is capable of performing tasks recommended by health professionals to manage pain, but would not believe that performing these tasks would lead to pain reduction.

Similarly, consider an individual with high IHLC but low pain-related self-efficacy, who would believe that performing recommended tasks leads to pain reduction, but would not feel competent in performing the tasks. Due to low self-efficacy, the individual would have low likelihood of attempting recommended pain-management behaviors. Either of these individuals may benefit less from MI than an individual who has high pain-related self-efficacy and a strong IHLC, who would expect recommended tasks to make a difference and who would feel capable of performing the tasks. Individuals with high DHLC may adhere well to treatment recommendations, but the correlations between PHLC and likelihood of chronic pain and disability suggest high DHLC or OHLC may be associated with reduced treatment benefits. High CHLC is likely to reduce treatment benefits, due to the belief that outside forces control the experience of pain. Notably, the research study by O'Hea et al. (2009) suggests that the strength of the relationship between self-efficacy and health outcomes may overpower the effect of IHLC on health outcomes when self-efficacy is high, which may be important in considering the results of analyses for the current study.

As discussed, HLOC and pain-related self-efficacy may be useful constructs for predicting how individuals will respond to health interventions. However, it is important to mention that this may not be the most appropriate way to approach poor outcomes to treatment. It may be more important to tailor interventions to address low self-efficacy or low IHLC, rather than using the variables to screen out individuals who may not benefit maximally from treatment. For instance, it is possible that current methods of intervention unnecessarily disadvantage those with an external locus of control, due to their emphasis on individual responsibility within a medical model (Wallston & Wallston, 1982; Härkäpää et al., 1991). Using information regarding the effect of HLOC and self-efficacy on treatment outcomes may assist in altering treatment interventions as necessary to best serve individuals across the HLOC and self-efficacy continuums. As Wallston and Wallston suggested, it may be of value to tailor interventions to the HLOC expectancies of patients. Similarly, it may be beneficial to tailor interventions to the level of pain-related self-efficacy.

To the knowledge of the current author, no studies to date have examined both HLOC and self-efficacy in predicting treatment outcomes of a MI program for chronic back pain. Such information could be valuable for two possible purposes: (1) developing helpful screening instruments to predict which patients may not benefit from MI, which is costly and time-consuming and (2) tailoring interventions to change patients' HLOC and self-efficacy, if it appears beneficial. It would be helpful to examine whether HLOC and pain-related self-efficacy predict improvements from MI programs over time, offering information regarding causality of these variables in relation to outcomes. Additionally, it would be beneficial to determine whether treatment-related changes in HLOC and self-efficacy are accompanied by improved outcomes following MI programs.

Limitations of existing research

Some limitations in the existing literature on HLOC and self-efficacy for back pain have already been mentioned. For instance, few of the studies on these constructs have focused specifically on back pain patients. Additionally, while numerous findings have supported the theoretical predictions based on these constructs, results have been inconsistent. Furthermore, these results have been almost completely cross-sectional and correlational in nature, offering little if any support for causal interpretations. To date, studies have not investigated the both self-efficacy and HLOC in predicting back pain, despite suggestions that combining these variables may increase the ability to predict health outcomes.

Research questions

This literature review offers hypotheses regarding HLOC and self-efficacy as predictors of treatment outcomes after receiving MI for chronic back pain, based in theory and research. Extant literature in the area of chronic back pain has failed to offer a clear picture of the effects of both HLOC and pain-related self-efficacy in predicting treatment outcomes. Furthermore, inconsistencies and limitations in the existing literature suggest more research in this area is needed to solidify theoretical relationships between HLOC, self-efficacy, and back pain. This study was conducted to answer the following questions:

1. Would the predictor variables (health locus of control and pain-related self-efficacy) and outcome variables that were measured both before and after treatment (depression, mental and physical health, and lift scores) demonstrate treatment-related changes from pre- to post-intervention and one month following intervention?

2. For back pain patients receiving MI, how would predictor variables (health locus of control and pain-related self-efficacy) relate to outcomes (functional capacity, return-to-work, disability level, self-reported physical and mental health, and depression) up to one month post-treatment?

3. Would intervention-related changes in predictors (health locus of control and pain-related self-efficacy) from baseline to the end of treatment predict physical outcomes (lift, return to work, disability, and self-reported physical health) and mental outcomes (self-reported mental health and depression) one month post-intervention?

CHAPTER 3

METHODS

Participants

Data collection included patients completing the two-week spine rehabilitation program at the University of Iowa Spine Center who consented to participate in the study from September 2007 to April 2009. All participants had severe chronic pain and low likelihood of benefiting from surgery. The Spine Center provided a two-week rehabilitation program to one group of patients per month, usually three to eight members per group. Group members consisted of patients invited to participate in the program after a full-day evaluation by the Spine Team. Patients were typically referred to the spine rehabilitation program by orthopedic surgeons and community physicians when their severe chronic back pain was unlikely to benefit from back surgery and/or when other treatments were found ineffective. See Appendix A for components of the spine rehabilitation program and follow-up evaluations.

All individuals who participated in the two-week spine rehabilitation program during the recruitment stage were eligible to participate in the study. Thus, the only screening of participants that occurred was selection by the Spine Team for participation in the spine rehabilitation program. To determine eligibility for the program, patients were evaluated by the Spine Team for severity of back pain, ability to manage their pain independently of the rehabilitation program, psychosocial factors that may interfere with potential to benefit from the program, and motivation for following treatment recommendations. To be invited to the program, patients were required to be 18 years old and above and English speaking. They needed to demonstrate motivation for participating in the program and making lifestyle changes. They were required to demonstrate a minimal level of physical ability to ensure they would not be injured during exercise portions of the program. Patients who presented with current substance abuse problems, including abuse of pain medications, were not eligible for the program. Additionally, patients with severe psychological difficulties (e.g., severe depression, anorexia) or medical issues that would interfere with their ability to participate in the program were not eligible. Patients who received an evaluation and were found ineligible due to motivation, substance abuse, physical ability, or psychological difficulties were able to be re-evaluated for entry into the program if they changed the preventing factor.

Instruments

Multidimensional Health Locus of Control (MHLC)

The MHLC is a measure commonly used to assess HLOC in medical populations. Three MHLC Forms exist: Forms A and B (Wallston, Wallston, & DeVallis, 1978), and Form C (Wallston, Stein, & Smith, 1994). Forms A and B, the original MHLC Forms, offer two versions to measure the same construct and are typically used with healthy individuals. Form C, the version used in the current study, is for use with individuals who have existing significant medical problems. Form C is worded so that the term “condition” is substituted with the specific ailment of the individuals being tested, which allows for situation-specific measurement of HLOC beliefs. In the current study, individuals were instructed to answer the questionnaire in reference to their pain.

The MHLC forms A and B include three 6-item scales that use Likert-type responses ranging from 1 (strongly disagree) to 6 (strongly agree). The *internal health locus of control* (IHLC) scale measures to what extent patients attribute their pain to their own behaviors (e.g., “I am directly responsible for my condition getting better or worse”). The *chance locus of control* (CHLC) scale assesses the level of patients’ belief that their pain is impacted by chance factors (e.g., “If my condition worsens, it’s a matter of fate”). In Form C, two separate 3-item subscales contribute to a *powerful others locus of control* (PHLC) orientation: the *doctors* (DHLC) and *other people* (OHLC) subscales (e.g., “Following doctor’s orders to the letter is the best way to keep my condition from getting any worse”). Each of the subscales is scored independently by summing the responses, giving a range of 6-36 for IHLC and CHLC, and 3-18 for DHLC and OHLC, with higher values reflecting higher levels of the construct.

The MHLC forms demonstrate moderate reliability, with Cronbach’s alpha ranging from .60 to .75, and one-month test-retest stability coefficients ranging from .40 to .80 when intervention did not occur between testing points (Wallston et al., 1994). When intervention occurred between testing points, which occurred six weeks apart, stability coefficients ranged from .35 to .64 (Wallston et al., 1994). Decreased stability following intervention demonstrates the sensitivity of the HLOC construct to treatment or life experience (Wallston et al., 1994).

Form C of the MHLC has demonstrated adequate criterion, convergent, and construct validity (Wallston, 2005). The subscales on Form C correlated with corresponding subscales on Form B, demonstrating criterion validity (r = .38-.65; Wallston, 2005). Regarding convergent validity, higher IHLC on Form C correlated with lower levels of pain and helplessness, higher CHLC was correlated with higher depressive symptoms and helplessness, and higher OHLC was correlated with helplessness (Wallston, 2005). Form C also demonstrated construct validity, as its subscale scores changed in theoretically predicted directions after pain management intervention (i.e., IHLC increased, other subscales decreased; Wallston, 2005). Additionally, researchers found that South Asians living in London responded lower on IHLC and higher on DHLC, OHLC and CHLC than Caucasian residents (Wrightson & Wardle, 1997). Therefore, despite showing acceptable reliability and validity, this measure has questionable utility with diverse groups. The MHLC was administered to all patients at baseline (before participation in the spine rehabilitation program), immediately after participation in the group, and at one-month follow-up.

Chronic Pain Self-Efficacy Scale (CPSS)

A number of measures have been used to examine self-efficacy in relation to back pain (Anderson, Dowds, Pelletz, Edwards, & Peeters-Asdourian, 1995). In previous studies, researchers have developed questionnaires assessing pain-related self-efficacy specifically for the purpose of their studies (e.g., Brox et al., 2005; Altmaier et al., 1993). Rather than develop a new measure to obtain high specificity, it was desirable to use an instrument that had previous reliability and validity information available. Therefore, for the purpose of this study, self-efficacy for dealing with chronic back pain was measured using the CPSS.

The CPSS was developed for use with chronic pain patients, altering items from the Arthritis Self-Efficacy (ASE) scale to reflect specific difficulties in a chronic pain population. Test development included many individuals with low back pain (Anderson et al., 1995). The CPSS includes items broadly applicable to chronic pain, and therefore appears relevant to general struggles faced by individuals with chronic back pain, although it may lack specificity recommended by Bandura (1997). The CPSS includes 22 items, rated on a ten-point Likert scale from 10 (very uncertain) to 100 (very certain). It contains three subscales, which are scored separately by calculating the mean of the responses given within each (range 10-100). The total scale score is calculated by adding subscale scores (range 30-300).

The PSE subscale contains five items assessing patients' *self-efficacy in pain management* (e.g., "How certain are you that you can keep your pain from interfering with your sleep"). The CSE subscale, containing 8 items, measures patients' belief in their ability to *cope with their pain* (e.g., How certain are you that you can deal with the frustration of chronic medical problems"). The FSE subscale consists of 9 items measuring patients' belief in their *general functional ability* (e.g., "As of now, how certain are you that you can walk ½ mile on flat ground"). Analyses for the current study utilized the total CPSS score as a measure of chronic pain-related self-efficacy. Anderson et al. (1995) published an article containing the complete content of this scale.

The CPSS has demonstrated internal reliability in individuals with pain, with subscale coefficient alphas ranging from .84 to .91 (Arnstein, Caudill, Mandle, Norris, & Beasley, 1999; Anderson et al., 1995), and total scale alpha of .95 (Arnstein et al., 1999). The scale has also demonstrated adequate construct validity, with all three subscales correlating positively with fewer depressive symptoms, more positive mood, and less hopelessness on the Beck Depression Inventory and the Beck Hopelessness Scale (Anderson et al., 1995). Furthermore, all three subscales correlated negatively with pain severity, interference, and affective distress and positively with life control on the Multidimensional Pain Inventory (Anderson et al., 1995). This measure was administered at baseline, immediately following the program, and at one-month follow-up.

Medical Outcomes Study Short Form 36 (SF-36)

This study used Version 2 of the Medical Outcomes Study Short Form 36 (SF-36v2) to assess HQOL as an outcome (Ware, Kosinski, & Dewey, 2000). The SF-36v2 includes 36 items to measure 8 health concepts (physical functioning; role limitations due to physical functioning; bodily pain; general health; vitality/energy; social functioning; mental health; and role limitations due to emotional functioning). The eight subscales fall under two broad dimensions, the physical health component summary (PCS) and the mental health component summary (MCS). Specifically, *the physical functioning, role physical, bodily pain, and general health* subscales load on the PCS, and the *vitality, social functioning, mental health, and role emotional* subscales load on the MCS (Ware et al., 2000). The current study focused on the PCS and MCS dimensions to evaluate physical and mental health status after participating in the two-week rehabilitation program. The PCS and MCS component scores were scored by computer, using the norm-based scoring (NBS) method with 1998 norm groups (Ware et al., 2000). Scoring of the PCS and MCS produces standard scores with a mean of 50 and standard deviation of 10 (Ware et al., 2000).

The SF-36v2 was developed as an update of the SF-36, a well-validated measure of physical and mental health (Ware, Kosinski, & Keller, 1994). The SF-36v2 reflects improved wording of instructions and items, improved format, increased comparability with other translations and cultural adaptations, and the changing of seven items from dichotomous to five-leveled in response options (Ware et al., 2000). The original SF-36 has demonstrated construct validity, with significantly higher means on all scales for patients with low back pain than in a healthy population. In comparing groups of individuals known to have varying levels of physical and mental health problems, the PCS and MCS of the original SF-36 demonstrated significantly different group means in the expected directions (e.g., PCS higher in group with medical conditions, MCS higher in group with psychiatric conditions; Ware et al., 1994), supporting the construct validity of the scales. Statistical analyses confirmed validity of the SF-36v2 subscales and component scores as compared to the SF-36, with all scales but role physical and role emotional having approximately equal item-scale correlations across the two versions. The role physical and role emotional scales demonstrated higher item-scale correlations on the SF-36v2 than on the SF-36 (Ware et al., 2000). The SF-36v2 has demonstrated high internal consistency reliability, with Cronbach's alpha for each of the eight subscales ranging from .82 to .95 (Ware et al., 2000). Factor analysis of the SF-36v2 has confirmed the two-factor higher-order structure (PCS and MCS) that has been well-documented in the SF-36 (Ware et al., 1994; Ware et al., 2000). The SF-36v2 was administered at baseline, immediately following the program, and at one-month follow-up.

Return-to-Work

Participants answered a questionnaire at one-month follow-up to assess whether they returned to work after completing the program. As mentioned by previous authors (e.g., Matheson, Isernhagen, & Hart, 2002), return-to-work has been measured in a variety of ways. For instance, some studies (Patrick et al., 2004; Feuerstein, Menz, Zastowny, & Barron, 1994) measured return-to-work using a yes/no measure. Others

(Matheson et al., 2002; Lanes et al., 1995) used a multi-level measure. Specifically, Matheson and colleagues assessed four levels of return-to-work that differed in the amount of change in work situation since receiving treatment. Alternatively, Lanes et al. used the qualitative outcome levels of good, fair, and poor, regarding whether the person was employed, looking for employment, or not seeking employment.

The Return-to-Work (RTW) questionnaire used in the current study was created for research and clinical use by the UI Spine Center, where the questionnaire is routinely administered at all follow-up time points (see Appendix B). The RTW questionnaire includes several options indicating current work status, which may also be dichotomized to employed or unemployed. Item groupings for the multi-level variable are as follows: no change from previous employment (items 1-4); return to previous employment with some modifications (items 5-6); change to a new position with the same employer due to physical restrictions (item 7); beginning a new job or training for a new job (items 8-9); and unemployed (items 10-11).

The overall structure used by Matheson et al. (2002) was used in forming the RTW measure, with slight alterations based on additional suggestions from the literature. For instance, some authors (Patrick et al., 2004; Feuerstein et al., 1994) noted the importance of including training for employment as a positive outcome. Additionally, other studies included retirement as a positive outcome (Lanes et al., 1995) and others included "usual duties" as a positive outcome for those who are self-employed (Patrick et al., 2004). Thus, the questionnaire includes wording to account for training as a positive outcome, as well as including retirement and self-employment as explicitly stated options.

Following recommendations by Matheson and colleagues (2002), the RTW measure was scored as two separate variables, using both a multi-level variable (in this case, based on level of change from previous employment) and a dichotomous variable (employed in a paid position, retired, or self-employed; versus unemployed). For the dichotomous variable, items 10 and 11 were recoded to a score of 0 to indicate unemployment, and items 1 through 9 were recoded to a score of 1 to indicate employment (or training for employment). For the multi-level variable, responses on the RTW measure were recoded to a scale from 1 (least desirable outcome) through 5 (most desirable outcome). Thus, selecting one of the items that indicated unemployment (items 10-11) led to a score of 1 in the multilevel variable. Items indicating a change in employment or training for a new job (items 8 -9) received a score of 2. A score of 3 was given to item 7, which represented change in position due to physical limitations. Items indicating some modifications while remaining in previous employment (items 5-6) received a score of 2. Finally, a score of 5 was given for no change in employment (items 1-4).

Functional capacity

For the purposes of the current study, it was desired to have an objective measure of functional capacity. Functional capacity evaluations (FCE) include a variety of measures of physical ability, including lumbar range of motion and lifting ability (e.g., Renemen, Brouwer, Meinema, Dijkstra, Geertzen, & Groothoff, 2004). According to previous studies, the ability to lift from floor to waist is the best predictor of return to work of all FCE measures, with other measures offering no additional explanatory power (Gross Battié, & Cassidy, 2004; Matheson et al., 2002). Considering the construct validity of floor-to-waist lifting demonstrated by its relationship to a key outcome (return-to-work), in addition to the limited explanatory power from other FCE components, floor-to-waist lifting served as the sole measure of functional capacity in this study.

Lifting ability was evaluated by a physical therapist, and was defined as the maximum number of pounds a patient was able to lift safely, and without an increase in back or neck pain. Therefore, higher numbers indicate higher functional capacity. Participants in the program are typically expected to lift between 10 and 30 pounds at baseline, with rare exceptions on both ends. Inter-rater reliability and test-retest reliability of similar lift measurements have been previously demonstrated with high interclass correlations (table-to-floor ICC = .95; Renemen, Brouwer, Meinema, Dijkstra, Geertzen, & Groothoff, 2004; shin-to-waist ICC = .94; Gouttebarge, Wind, Kuijer, Sluiter, & Frings-Dresen, 2006). The functional capacity evaluation was conducted at baseline, immediately following participation in the program, and at one-month follow-up.

Oswestry Disability Index, Version 2 (ODIv2)

The ODI has been termed the “gold standard” in disability measurement and has been recommended as part of a standardized battery of outcome assessment for back pain patients (Fairbank & Pysent, 2000; Deyo et al., 1998). The questionnaire contains ten items to assess to what extent pain currently interferes with patients’ ability to perform various functions (e.g., travel, walk, sit). Each item contains six response options (0-5), increasing from no limitation to complete inability to perform the activity (e.g., “I can travel anywhere without pain”; “Pain prevents me from traveling except to receive treatment"). The ODI disability percentage is scored by dividing the total score (summing the highest numbers circled under each item), by the total possible score (50), and multiplying by 100 (Fairbank & Pysent, 2000). Higher numbers indicate higher percentage of disability. Version 2 of the ODI, which contains slight rewording of some item responses, has been recommended by the original measure's authors as preferable to the original version (Fairbank & Pysent, 2000). Importantly, the Spine Center's computer scoring system reverses these scores, so that *higher* scores indicate lower disability and *better* outcomes.

The original ODI (Version 1) has demonstrated high test-retest reliability (24 hours, r = .99; 4 days, r = .91; 1 week, r = .83; Fairbank & Pysent, 2000). Version 2 of the ODI has also demonstrated acceptable internal consistency reliability (Cronbach's alpha = .76-.87) and has shown convergent validity with other commonly used pain measures (e.g., McGill Pain Questionnaire, a visual analogue scale), with disability measures (e.g., Pain Disability Index, Low Back Outcome Score) and with numerous physical measures (e.g., functional capacity evaluations, pain with sitting and standing, isokinetic performance, isometric endurance; Fairbank & Pysent, 2000). Version 2 has also shown high correlation between a computer version and a paper version (r = .89, Fairbank & Pysent, 2000). This questionnaire was administered at one-month follow-up.

Beck Depression Inventory-II (BDI-II)

The BDI-II served to measure a critical mental health outcome, depression. The BDI-II is used to detect possible depression in normal populations, and assesses severity of depression in diagnosed patients (Beck, Steer, & Brown, 1996). It contains 21 multiple-choice items, which correspond to diagnostic criteria for depression. Each item assesses a symptom of depression, such as change in appetite, with four separate statements that vary from a lack of the symptom (0) to severe presence of the symptom (3). All items but two include four statements (0-3). The items assessing appetite change and change in sleep allow eight options, assessing either increase or decrease in the behavior. The participant is instructed to circle one statement for each item that best applies over the "past two weeks, including today." The measure is scored by summing the highest number circled under each item, giving a possible total of 0 to 63. Beck, Steer, and Brown (1996) presented ranges that indicate minimal (0-13), mild (14-19), moderate (20-28) and severe depression (29 and above).

When used with medical patients, the BDI-II has demonstrated high internal consistency (alpha = .94; Arnau, Meagher, Norris, & Bramson, 2001). The BDI-II has demonstrated high construct validity, correlating strongly with the likelihood of being diagnosed with a mood disorder ($p < .001$; Beck, Steer, Ball, & Ranieri, 1996). It has also shown criterion validity, with scores differing significantly between groups who were or were not diagnosed with major depressive disorder (Arnau et al., 2001). Furthermore, the BDI-II has demonstrated convergent and discriminant validity, correlating more highly with the Hamilton Psychiatric Rating Scale for Depression ($r = .71$) than with the revised Hamilton Rating Scale for Anxiety ($r = .47$; Beck, Steer, Ball, & Ranieri, 1996); and correlating more strongly with the Mental Health subscale of the Medical Outcomes Study Short Form General Health Survey (SF-20, $r = -.65$) than with other subscales of the SF-20 ($r = -.35$ to $-.42$; Arnau et al., 2001). The BDI-II was administered at baseline, immediately following treatment, and at one-month follow-up.

Data Management

Data collected for the MHLC and CPSS were managed by the current research team. Lift scores were obtained through the Spine Team physical therapist or via patient records. All other data were provided by Spine Center data managers who either entered data directly from hard copy or extracted data from a computer database. To maximize the inclusion of predictor variables in final analyses, a formula was developed to substitute the mean of other items for missing values on subscales of the MHLC and CPSS. Specifically, based on recommendations by the creators of the MHLC, the mean of completed items was substituted for any missing items only if at least 2/3 of the data was present for a given subscale. Thus, the mean was substituted if no more than 33% of the data was missing. The IHLC and CHLC subscales have six items each, which led to substitution if one or two items were missing.

On the DHLC and OHLC subscales, which have three items each, missing values received substitutions only if one item was missing. If a participants' subscale was missing more than two items (for IHLC and CHLC) or one item (for DHLC and OHLC), the subscale score was omitted completely from analyses. For the CPSS, a similar substitution formula was used so that mean values were substituted for missing values on a given subscale only if less than 33% of the subscale was missing. Total scores on the CPSS were calculated by adding together subscale scores after requisite substitutions were performed on each subscale.

Procedures

Patients were approached upon beginning the two-week spine rehabilitation program to seek consent for their participation in the current study. For clinical purposes, all patients participating in the spine rehabilitation program filled out computer versions of the SF-36, and a paper version of the BDI-II, and they received a functional capacity evaluation at the start of the program. After giving informed consent, participants received baseline measures that were not already given for clinical purposes within the program. That is, in addition to measures already given by the Spine Center (functional capacity evaluation, SF-36, and BDI-II), the patients received the MHLC and the CPSS in paper format. The patients participated in an intensive, multidisciplinary, two-week rehabilitation program (see Appendix A). They received the same measures, including functional capacity evaluations, at the end of the two-week spine rehabilitation program. Patients were also asked to fill out the measures and received functional capacity evaluations when they returned for follow-up one month following the end of treatment (see Appendix A). At this time point, they were also administered the return-to-work questionnaire and the ODIv2. For those who do not attend the follow-up appointment, paper versions of all measures were mailed with a stamped, addressed envelope in which to return them. Therefore, functional capacity evaluations were not available for participants who do not attend follow-up appointments but completed forms by mail.

The current study originally intended to include measures up to three months following treatment. Worker's compensation policy changes following the initiation of the project led to lack of reimbursement for extended follow-up and increased denial of work leave for these appointments. Thus, the number of patients attending follow-up appointments beyond one month dropped significantly (approximately half the number who attended one-month appointments), and for the purposes of the current study, analyses for three-month follow-up were omitted.

CHAPTER 4

RESULTS

This chapter serves to describe the results of all statistical analyses conducted for the current study. The first section describes preliminary analyses conducted, including analyses of internal consistency reliability, variable intercorrelations, and descriptive statistics for all predictor and criterion variables as well as demographics. This section also compares sample means for this study to those found in the literature for similar studies. The next section describes the analyses conducted to examine each of the research questions proposed above. All statistical analyses were run using SPSS version 17.0 for Windows. Results indicating $p < .05$ were considered significant for all analyses.

Descriptive Statistics

Ninety-seven group members in the spine rehabilitation program were provided the opportunity to participate in the current study. Of these 97 group members, 78 participants (42 females and 36 males) initially agreed to participate in the study and completed forms at baseline (T0), creating an 80% recruitment rate. Six of the initially recruited participants did not complete the two-week rehabilitation program and thus were not included in the study. One participant's data was omitted after recruitment due to an extended gap (two years) between the Spine Center's baseline evaluation and the individual's participation in the rehabilitation program. Three participants left early on the last day of the program, with two completing only lift scores at T1, and one completing no T1 measures. Data for these participants remained in the data set due to their completion of all measures at baseline and follow-up. One month after treatment

(T2), 61 participants completed at least half of the follow-up forms, with 8 sending their questionnaires through the mail. Table 1 lists demographic information for the 61 participants included in analyses. For demographic information describing the data for all individuals who were recruited for this study, please see Appendix C, Table C1.

Independent-samples *t* tests were conducted to compare those who completed data at one-month follow-up to those who did not. A significant difference was found in the age of those who completed one-month follow-up ($M = 47.6$, $SD = 11.1$) compared to those who did not complete follow-up measures ($M = 36.2$, $SD = 10.2$), $t(76) = -3.87$, $p < .001$. That is, those who completed one-month follow-up measures were significantly older than those who did not. Additionally, participants who completed measures at T2 lifted less weight from floor to waist at baseline ($M = 28.8$, $SD = 17.9$) than those who did not complete T2 measures ($M = 40.8$, $SD = 19.0$), $t(64) = 2.093$, $p = .04$. Baseline lift scores were missing from this comparison for 6 participants who did not complete T2 measures and 5 participants who completed T2 measures. These groups demonstrated no significant differences on baseline measures of HLOC, self-efficacy, depression, and physical and mental well-being.

Table 2 lists sample ranges, means, and standard deviations for all variables at all time points. All subscales of the MHLC demonstrated means similar to those reported by other researchers studying pre-treatment chronic pain samples (Wallston, Stein, & Smith, 1994). The mean of T0 CPSS scores in the current study ($M = 178.43$) was slightly higher than that reported by Arnstein et al. (1999), who found a mean of 143 for CPSS scores in a sample of outpatients with chronic back pain. The SF-36 MCS and PCS scores measured at T1 and T2 in the current study demonstrated similar means to those reported by Asante, Brintnell, and Gross (2007), who measured scores in a group of individuals with back pain shortly before discharging from a rehabilitation program. Thus, the sample for the current study demonstrated levels of emotional and physical difficulties (including pain), and limitations related to these difficulties, similar to those previously reported in back pain patients who had received rehabilitative intervention.

Participant data was included for the 61 participants who completed measures at T2, even if they did not complete all measures at all time points. Power analyses based on a previous study utilizing similar methodology and instruments (Hochhausen et al., 2007) indicated this study required at least 62 participants to achieve a power level of .8 for regression analyses. In an effort to achieve a number close to this goal, it was desirable to include as many participants as possible in each analysis. Thus, all available data were included even for participants who failed to complete some measures, creating varied Ns across analyses. Please see Table 2 for descriptive statistics and Cronbach's alpha for each variable as measured in the 61 participants who completed data at one-month follow-up. Please note that analyses including these variables may have lower *N*s in the analyses due to elimination of cases pairwise in correlations and listwise in analyses of variance (ANOVAs) and regressions. Furthermore, although 61 participants completed at least some measures at T2, *N*s for each separate variable differ as a result of different participants failing to complete different measures.

Table 1. Demographics ($N = 61$)

	Frequency	Percent
Gender		
Male	28	46
Female	33	54
Race		
Latino American	2	3
African American	1	2
Caucasian	58	95
Education		
Below H.S.	3	7
H.S. or GED	9	20
Some college or T.C.	20	45
College graduate	10	23
Master's degree	2	5
Relationship status		
Single	3	6
Cohabiting	1	2
Married	36	68
Divorced	11	21
Widowed	1	2
Separated	1	2

Note: Numbers for education and relationship status represent a subset of patients for whom this information was provided. H.S. = high school; GED = General Educational Development; T.C. = technical college.

Table 2. Descriptive Statistics (*N* = 61)

Variable	*N*	Range	Mean	Standard Deviation	Cronbach's α*
Age					
	61	28 – 72	47	11	
CPSS					
T0	60	60 – 290	176	52	.96
T1	53	120 – 297	242	43	.96
T2	57	32 – 300	212	64	.98
IHLC					
T0	61	7.2 – 36	22.72	6.13	.80
T1	54	13 – 36	27.48	5.46	.76
T2	58	6 – 36	24.93	7.35	.88
CHLC					
T0	61	6 – 26	14.92	4.68	.63
T1	54	6 – 23	12.06	4.92	.74
T2	58	6 – 27	13.11	5.00	.72
DHLC					
T0	61	5 – 18	11.44	2.96	.51
T1	54	4 – 18	10.44	3.77	.62
T2	58	6 – 18	11.43	2.96	.33
OHLC					
T0	61	4 – 15	8.70	2.53	.33
T1	54	3 – 11	6.28	2.28	.30
T2	58	3 – 13	6.28	2.68	.61
Lift Score					
T0	55	0 – 100	28.86	17.74	
T1	55	0 – 105	37.55	20.70	
T2	52	0 – 105	40.10	23.59	
BDI-II					
T0	58	0 – 53	17.40	11.09	.93
T1	57	0 – 31	6.67	6.70	.89
T2	57	0 – 37	8.37	8.95	.95
PCS					
T0	59	12 – 48	30.99	5.78	
T1	57	11 – 57	41.48	8.01	
T2	60	15 – 56	39.69	8.66	
MCS					
T0	59	10 – 63	39.66	13.95	
T1	57	23 – 65	49.00	11.42	
T2	60	7 – 66	46.44	13.25	
ODIv2					
T2	59	22 – 100	65.28	18.91	.89

Table 2 – continued

Note: T0 = baseline; T1 = end of treatment; T2 = one-month follow-up; CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; OHLC = health locus of control for others; Lift Score = floor-to-waist lift; BDI-II = Beck Depression Inventory - II; PCS = Physical Component Scale; MCS = Mental Component Scale; ODIv2 = Oswestry Disability Index version 2.

Preliminary Analyses

Outliers

Examination of data for potential outliers or violation of normality was conducted by calculating skewness and kurtosis scores for each variable. Based on recommendation by Heppner and Heppner (2004), outliers were addressed for variables with skewness or kurtosis values greater than the absolute value of two. This rule indicated closer examination of outliers for T0 lift scores (skewness = 2.4, kurtosis = 9.04), T1 lift scores (skewness = 1.6, kurtosis = 3.88), T1 BDI-II scores (skewness = 1.7, kurtosis = 3.1), and T2 BDI-II scores (skewness = 1.7, kurtosis = 3.1). Closer examination of potential outliers in lift scores led to the identification of one participant who lifted 150 pounds at both T0 and T1, producing z-scores of 5.0 and 4.1, respectively, at these time points. The elimination of this outlier in T0 and T1 lift scores led to acceptable skewness and kurtosis values (T0 skewness = 1.1, kurtosis = 2.0; T1 skewness = .86, kurtosis = .57) for these variables. Examination of T1 BDI-II scores revealed an outlying score of 34 ($z = 3.7$). When this score was eliminated, more acceptable skewness (1.5) and kurtosis (2.2) scores were produced for this variable. Similarly, an outlier of 48 ($z = 3.8$) was eliminated from T2 BDI-II scores, producing acceptable skewness (1.4) and kurtosis (1.8) scores. In each case in which an outlying score was eliminated, the participants' scores on other variables remained in the data set to be included in other analyses, due to desire to maximize *N* for as many analyses as possible.

Instrument reliability

To estimate internal consistency, Cronbach's alpha was calculated for all instruments for which raw data were available (see Table 2). Analyses produced an alpha coefficient of .89 for the ODIv2, which is higher than the alpha range of .76 to .87 found in previous research (Fairbank & Pysent, 2000). The BDI-II produced coefficient alpha ranging from .89 to .95, equivalent to that found in a previous study with medical patients (Arnau et al., 2001). In the current study, the CPSS demonstrated alpha coefficients ranging from .96 to .98, which is similar to the alpha of .95 established in an earlier study (Arnstein et al., 1999). Thus, the instruments used to measure level of disability, depression, and chronic pain self-efficacy demonstrated acceptable levels internal consistency with alpha values similar to those found in previous studies.

Cronbach's alpha coefficients for IHLC, and CHLC, were generally acceptable and similar to the range of .60 to .75 found in previous research (Wallston et al., 1994). The DHLC demonstrated acceptable alpha at T0 and T1, (.51 and .62, respectively), but low alpha at T2 (.33). The DHLC was used in subsequent analyses due to the emphasis on use of the MHLC subscales as baseline predictors. That is, a primary goal of the current study was to examine the predictive value of baseline MHLC and CPSS scores on outcomes measured at one-month follow-up. Due to the fact that the DHLC demonstrated acceptable internal consistency at T0, this measure was retained in subsequent analyses, most of which used only T0 values for DHLC. The OHLC, however, demonstrated a low level of internal consistency at T0 and T1. Due to the low internal consistency of this predictor variable measured at baseline, the OHLC subscale was omitted from all subsequent data analyses.

Due to the variations in response types used to calculate PCS and MCS component scores, Cronbach's alpha was not calculated for these subscales. As noted previously in the Methods section of this manuscript, reliability for SF-36v2 has been well-documented (Ware et al., 2000).

Variable intercorrelations

Table 3 displays Pearson *r* values for correlations between all variables collected at baseline (T0) including age and gender, which were included as covariates in subsequent analyses. At this time point, a number of significant relationships existed between predictor variables (CPSS, IHLC, CHLC, DHLC), outcome variables that were measured at baseline (lift, PCS, MCS, BDI-II), and covariates. For instance, chronic pain self-efficacy was significantly correlated with several variables, including positive relationships with age, mental well-being, and floor-to-waist lift scores. Self-efficacy was negatively related to depression level, i.e., higher chronic pain self-efficacy was related to lower levels of depression at baseline. Chance health locus of control (CHLC) and locus of control for medical professionals (DHLC) were positively correlated. In turn, both variables demonstrated a positive correlation with age.

Table 3. Intercorrelations of Baseline Variables Using Pearson *r*

	1	2	3	4	5	6	7	8	9	10
1. CPSS	1	.29*	-.20	-.15	.40**	-.33**	.24	.30*	.26*	.09
2. IHLC		1	-.07	.20	.21	-.24	-.10	.21	.00	-.02
3. CHLC			1	.28*	-.01	.15	-.12	-.25	-.03	.26*
4. DHLC				1	-.26	.02	-.06	-.14	.26*	.11
5.Lift					1	-.16	.17	.28*	-.10	.37**
6. BDI-II						1	-.05	-.78**	-.12	-.08
7. PCS							1	-.03	-.13	.15
8. MCS								1	.13	-.11
9. Age									1	-.13
10. Gender										1

Note: The variable gender was coded as 0 = female and 1 = male. CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; Lift = floor-to-waist lift; BDI-II = Beck Depression Inventory - II; PCS = Physical Component Scale; MCS = Mental Component Scale.

*$p < .05$, **$p < .01$

To summarize, the final data set used for analyses included scores for 61 participants who completed measures at one-month follow-up (T2). Two of these 61 participants completed only the lift measure at T1, and one completed no T1 measures. Preliminary correlations offered evidence of a number of expected correlations between variables, which were measured with more attention to the impact over time as well as potential covariate relationships among variables in subsequent analyses.

Research Question 1

Did the predictor variables (health locus of control and pain-related self-efficacy) and outcome variables that were measured both before and after treatment (depression, mental and physical health, and functional capacity) demonstrate treatment-related changes from pre- to post-intervention and one month following intervention?

Predictor variables: Health locus of control

A total of 51 participants completed the MHLC at baseline (T0), at the end of treatment two weeks later (T1), and one month following the end of the Spine Rehabilitation Program (T2). Separate one-way repeated-measures ANOVAs were conducted to compare scores on the subscales of the MHLC (IHLC, CHLC, and DHLC) at T0, T1, and T2. For ANOVAs demonstrating a significant effect for time, pairwise ANOVAs were conducted post-hoc using a Bonferroni correction to reduce the probability of Type 1 error in examining significant differences between mean scores at each time point. The ANOVA analyses for examination of treatment-related change are summarized in Table 4.

Please see Figure 1 for an illustration of the change in mean scores for each subscale from baseline to follow-up. Initial ANOVAs indicated that the subscales IHLC and CHLC demonstrated significant treatment-related change, and DHLC did not demonstrate change. Post-hoc analyses revealed that IHLC, which signifies the extent to which an individual believes his or her actions contribute directly to health status, increased significantly from T0 to T1, $p < .001$, and from T0 to T2, $p = .007$. Notably, IHLC scores peaked at T1, and the decline from the end of the program to follow-up was also statistically significant, $p = .03$.

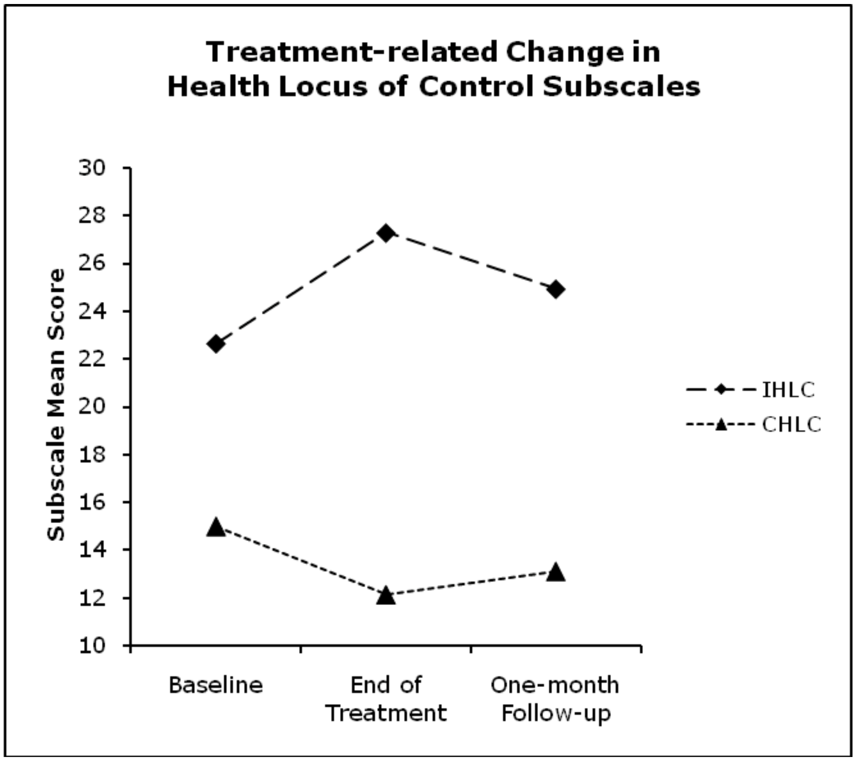
Table 4. Treatment-related Change of Health Locus of Control in One-Way, Within-Subjects ANOVAs

	Source	*N*	*df*	*F*	η_p^2	*p*
IHLC						
	Time	51	2	18.79	.27	<.001
	T0 vs T1		1	42.85	.46	<.001
	T0 vs T2		1	10.43	.17	.007
	T1 vs T2		1	7.34	.13	.03
CHLC						
	Time	51	2	7.08	.12	.001
	T0 vs T1		1	10.71	.18	.006
	T0 vs T2		1	8.16	.14	.02
	T1 vs T2		1	.81	.02	1.00
DHLC						
	Time	51	2	2.57	.05	.08

Note: Pairwise comparisons are reported using Bonferroni-adjusted *p* values. T0 = baseline; T1 = end of treatment; T2 = one-month follow-up. IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals.

Chance HLOC, which measures the belief that one's health is influenced by chance factors or fate, also demonstrated a significant change from pre-treatment to post-treatment. Post-hoc analyses indicated that CHLC declined significantly from T0 to T1, *p* = .006, and from T0 to T2, *p* = .02. Mean scores on the CHLC at T1 and T2 were not significantly different.

Figure 1. Change in Multidimensional Health Locus of Control



Predictor variables: Chronic pain self-efficacy

Forty-eight participants completed the CPSS scale at baseline (T0), end of treatment (T1), and one-month follow-up (T2). Chronic pain self-efficacy, signifying one's perceived ability to perform tasks associated with pain control, changed significantly over time (see Figure 2). Specifically, post-hoc tests indicated that scores on the CPSS scale increased significantly from T0 to T1, $p < .001$, and from T0 to T2, $p < .001$. As with internal HLOC, the mean score on CPSS reached its highest point at the end of the Spine Rehabilitation Program, and the decline from end of treatment to one-month follow up was also significant, $p < .001$ (see Table 5).

Figure 2. Change in Mean Scores on the Chronic Pain Self-efficacy Scale

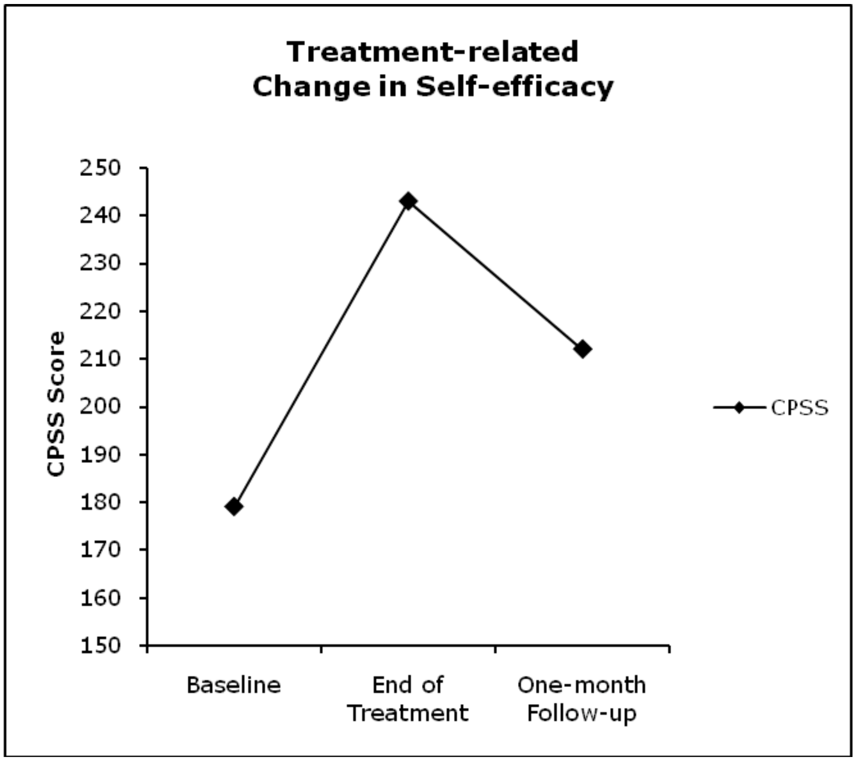


Table 5. Treatment-related Change of Chronic Pain Self-efficacy in One-Way, Within-Subjects ANOVA

	Source	*N*	*df*	*F*	η_p^2	p
CPSS						
	Time	48	2	60.76	.56	<.001
	T0 vs T1		1	115.50	.71	<.001
	T0 vs T2		1	35.95	.43	<.001
	T1 vs T2		1	25.14	.35	<.001

Note: Pairwise comparisons are reported using Bonferroni-adjusted *p* values. T0 = baseline; T1 = end of treatment; T2 = one-month follow-up. CPSS = Chronic Pain Self-efficacy Scale.

To summarize, all predictor variables except DHLC, which indicates the extent to which health status is considered a direct result of medical professionals, demonstrated treatment-related change from baseline to follow-up. Both IHLC and CPSS increased from baseline to the end of treatment and from baseline to one-month follow-up, with a significant decline from the end of treatment to follow-up. The subscale for CHLC, indicating external, chance-related, expectations for the control of one's health, declined significantly from baseline to the end of treatment and maintained this decline without signification change from the end of treatment to one-month follow-up. See Table 6 for a summary of means and standard deviations for the participants who completed these questionnaires at all time points.

Table 6. Mean Values for Treatment-related Change in Predictor Variables

		Baseline		End of treatment		1-month follow-up	
Variable	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*
CPSS	48	177	53	241	44	216	61
IHLC	51	22.84	5.62	27.43	5.45	25.33	7.03
CHLC	51	14.91	4.43	12.24	4.93	12.85	4.85
DHLC	51	11.43	2.95	10.41	3.67	11.18	2.77

Note: CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals.

Outcome variables: Physical health factors

Table 7 summarizes ANOVAs examining the change in physical health outcome variables (lift and PCS) from baseline to follow-up. The RTW and ODIv2 scores were collected at T2 only, precluding the ability to examine their change from baseline to follow-up. Separate one-way repeated-measures ANOVAs were conducted to compare scores on functional capacity (lift) and self-reported physical health (PCS) between baseline, end of treatment, and follow-up measurements. Floor-to-waist lift score, a measure of functional capacity, demonstrated significant change over time in an analysis that included 50 individuals who completed functional capacity evaluations at all time points. Post-hoc analyses indicated that lift scores increased significantly from T0 to the T1, $p < .001$, and from T0 to T2, $p < .001$. Scores did not change significantly from end of treatment to follow-up (see Figure 3).

Table 7. Treatment-related Change of Physical Health Outcomes in One-Way, Within-Subjects ANOVAs

	Source	*N*	*df*	*F*	η_p^2	*p*
Lift						
	Time*	50	1.248	22.39	.31	<.001
	T0 vs T1		1	29.71	.38	<.001
	T0 vs T2		1	22.66	.32	<.001
	T1 vs T2		1	2.50	.05	.36
PCS						
	Time	55	2	53.76	.50	<.001
	T0 vs T1		1	85.85	.61	<.001
	T0 vs T2		1	59.18	.52	<.001
	T1 vs T2		1	3.86	.07	.16

Note: Pairwise comparisons are reported using Bonferroni-adjusted *p* values. T0 = baseline; T1 = end of treatment; T2 = one-month follow-up. Lift = floor-to-waist lift score; PCS = Physical Component Scale.

* Greenhouse-Geisser values used due to violation of sphericity assumption for lift scores.

Self-reported physical health, as measured by the PCS on the SF-36v2, demonstrated significant change over time in 55 participants who completed the instrument at all time points. Post-hoc analyses indicated that from T0 to T1, PCS scores increased significantly, $p < .001$. Comparisons from T0 to T2 also demonstrated a significant increase in self-rated physical health, $p < .001$. The PCS scores were not significantly different from T1 to T2 (see Figure 4). Thus, both indices of physical health improved from baseline to the end of treatment, with no significant change from the end of treatment to one-month later. Please see Table 8 for a summary of means and standard deviations for the participants who completed these measures of physical health at all time points.

Figure 3. Change in Functional Capacity from Baseline to One-month Follow-up

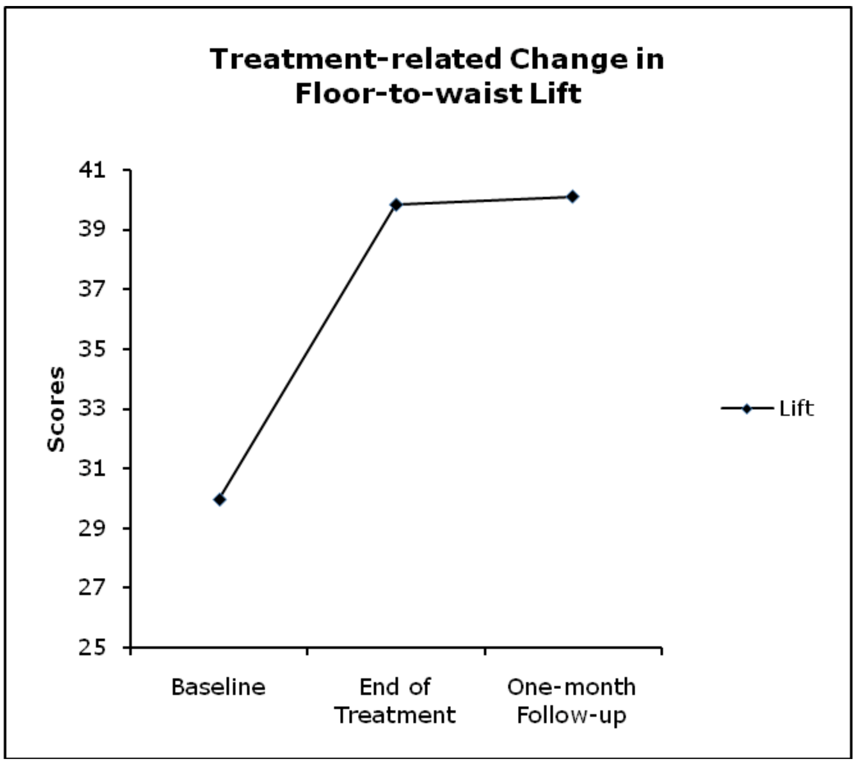


Figure 4. Change in Physical Health Reports from Baseline to One-month Follow-up

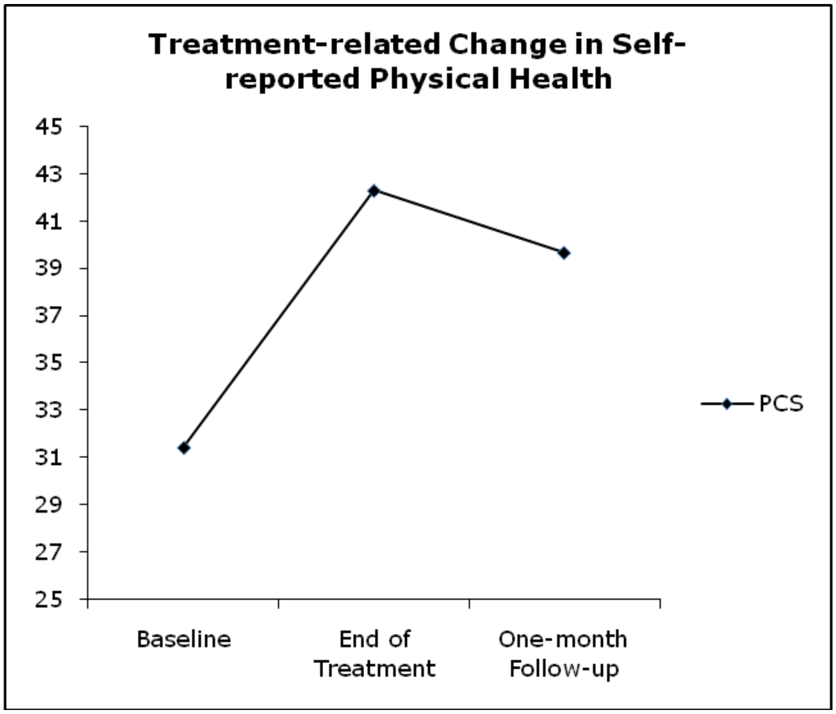


Table 8. Mean Values for Treatment-related Change in Physical Health Outcomes

		Baseline		End of treatment		1-month follow-up	
Variable	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Lift Score	50	28.85	18.36	38.20	21.30	39.90	24.02
PCS	55	30.80	5.84	41.45	8.06	39.50	8.93

Note: Lift = floor-to-waist lift score; PCS = Physical Component Scale.

Outcome variables: Mental health factors

Table 9 provides a summary of ANOVAs examining treatment-related change in mental health outcome variables. Self-reported mental health, as measured by the SF-36v2 MCS, demonstrated significant change over time. Based on post-hoc analyses, mean score on the MCS demonstrated a significant increase, indicating improvement in mental health, from T0 to T1, $p < .001$, and from T0 to T2, $p = .001$. Scores on the MCS showed no significant difference from T1 to T2 in 55 participants who completed the measure at all time points. Thus, self-reported mental health increased significantly from baseline to the end of treatment, and improvements were maintained over time with no significant change at one-month follow-up (see Figure 5). Depression scores on the BDI-II also demonstrated a change over time in 51 participants who completed the instrument at all time points. Post-hoc analyses revealed that depression levels improved, i.e., decreased significantly from T0 to T1, $p < .001$, and from T0 to T2, $p < .001$. Scores on the BDI-II demonstrated no significant change from T1 to T2. Thus, depression level improved from baseline to the end of treatment, and improvements were sustained with no significant change from the end of treatment to one-month later (see Figure 6).

Table 9. Treatment-related Change of Mental Health Outcomes in One-Way, Within-Subjects ANOVAs

	Source	*N*	*df*	*F*	η_p^2	*p*
MCS						
	Time	55	2	16.74	.24	<.001
	T0 vs T1		1	32.78	.38	<.001
	T0 vs T2		1	15.28	.22	.001
	T1 vs T2		1	2.78	.05	.305
BDI-II						
	Time	51	2	44.57	.47	<.001
	T0 vs T1		1	75.99	.60	<.001
	T0 vs T2		1	43.35	.46	<.001
	T1 vs T2		1	4.26	.08	.13

Note: T0 = baseline; T1 = end of treatment; T2 = one-month follow-up. MCS = Mental Component Scale; BDI-II = Beck Depression Inventory – II.

Figure 5. Change in Self-reported Mental Health from Baseline to One-month Follow-up

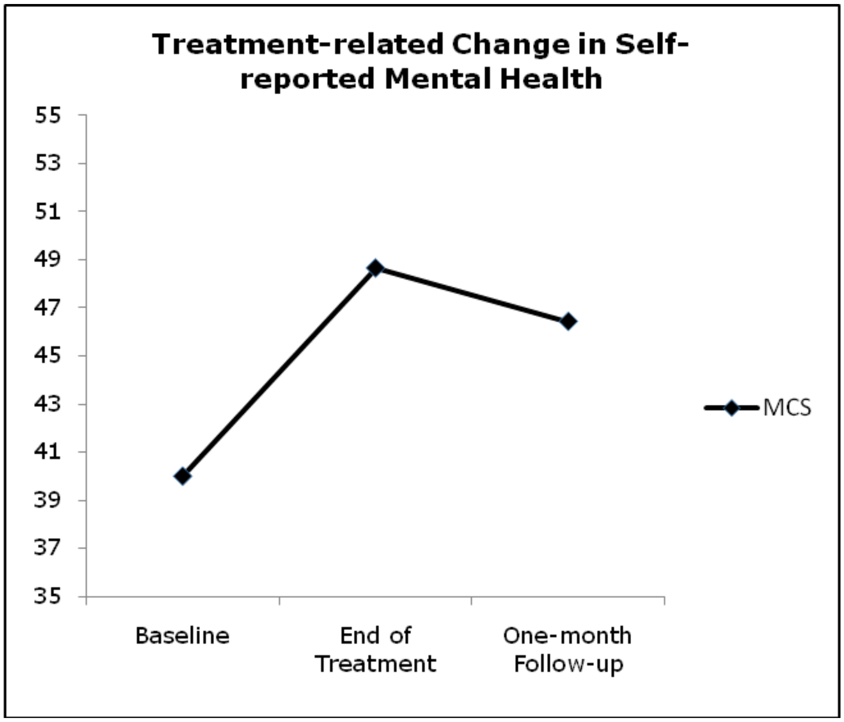


Figure 6. Change in Depression from Baseline to One-month Follow-up

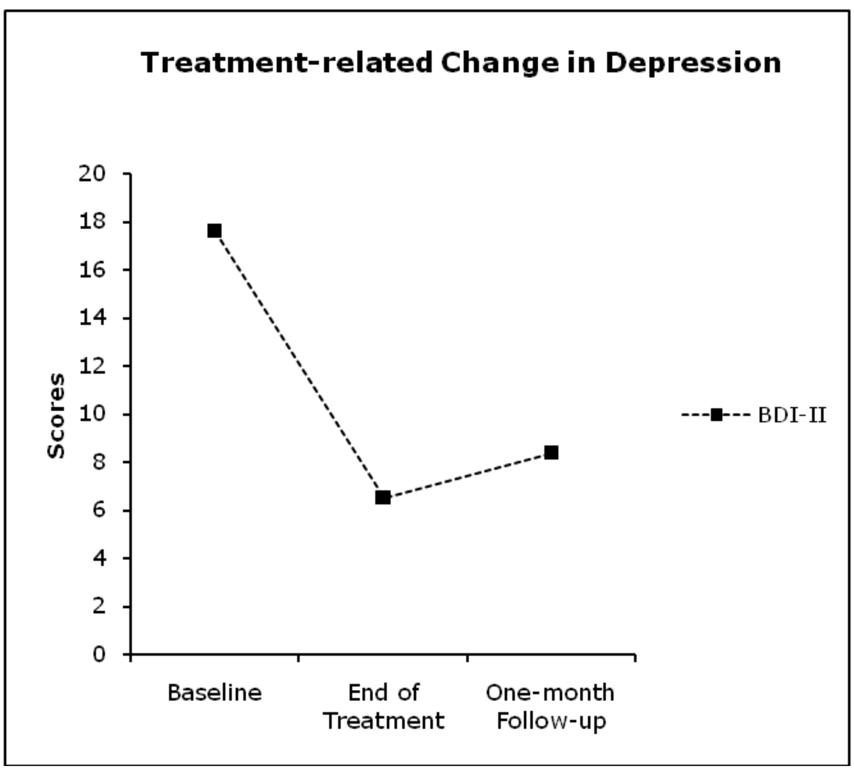


Table 10. Mean Values for Treatment-related Change in Mental Health Outcomes

		Baseline		End of treatment		1-month follow-up	
Variable	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*
MCS	55	39.63	14.36	49.52	11.05	46.59	13.40
BDI-II	51	16.41	10.19	6.63	6.71	8.63	9.22

Note: MCS = Mental Component Scale; BDI-II = Beck Depression Inventory – II.

Research Question 2

For back pain patients receiving MI, how do predictor variables (health locus of control and pain-related self-efficacy) relate to outcomes (functional capacity, return-to-work, disability level, self-reported physical and mental health, and depression) up to one month post-treatment?

Physical health outcomes

This question was answered using hierarchical multiple regression analyses to determine the predictive value of each predictor variable (IHLC, CHLC, DHLC, and CPSS) on physical outcomes that were measured as continuous variables (lift, ODIv2, and PCS). The first block of each regression included age, gender, and, when available, the baseline score for the outcome measure of interest to control for differences in functioning accounted for by these variables. The second block of each analysis consisted of baseline subscales measuring health locus of control (IHLC, CHLC, and DHLC), and baseline pain-related self-efficacy (as measured by the CPSS). A hierarchical regression was conducted as delineated above for each of the following physically-based outcome variables, as measured one month following treatment: floor-to-waist lift scores, ODIv2, and PCS. Thus, each of these multiple regression analyses included a T2 outcome variable as the criterion; age, gender, and T0 measurement of the outcome variable in the first block as controls; and T0 IHLC, CHLC, DHLC and CPSS in the second block as predictor variables. Values of $p < .05$ were considered significant.

Please see Table 11 for results of the regression analyses examining the relationship between T0 predictor variables (IHLC, CHLC, DHLC, and CPSS) and T2 lift as the outcome variable. Results indicated a significant effect for Block 1. Specifically, T0 lift scores and gender were positively predictive of lift scores at T2. That is, males and individuals who lifted more at baseline demonstrated higher lift ability at T2 than females and those who lifted less at baseline.

Table 11. Hierarchical Regression Analysis for Prediction of Lift Scores

Criterion	Predictors	β	F	R^2	Adj. R^2	ΔR^2
Lift Scores (N = 50)						
Block 1			23.60***	.61	.58	
	T0 Lift	.62***				
	Age	.02				
	Gender	.28**				
Block 2			7.66***			.17
	CPSS	.27**				
	IHLC	.20*				
	CHLC	.26**				
	DHLC	-.26**				
Full Model			20.34***	.77	.73	

Note: Standardized β values listed. T0 = baseline; CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; Lift = floor-to-waist lift.

*$p < .05$, **$p < .01$, ***$p < .001$

After controlling for Block 1 variables, baseline chronic pain self-efficacy, as measured by the CPSS, was uniquely predictive of lift scores. Specifically, higher levels of chronic pain self-efficacy at baseline were related to the ability to lift more weight at one-month follow-up. After Block 1 variables were entered, T0 IHLC, CHLC, and DHLC were also significant predictors of T2 lift scores. Higher IHLC at baseline, indicating a belief that one's actions directly impact one's health status, predicted higher functional capacity at follow-up as measured by floor-to-waist lift. Surprisingly, higher baseline CHLC, which measures the extent to which an individual believes his or her health is impacted directly by chance factors, was associated with higher lift scores at one-month follow-up. As expected, higher belief at T0 that health status was directly impacted by medical professionals, i.e., DHLC, was predictive of lower lift scores at T2.

A hierarchical regression analyses examined the relationship between T0 predictor variables (IHLC, CHLC, DHLC, and CPSS) and T2 ODIv2 as the outcome variable. Block 1, which included age and gender as control variables, was not significantly predictive of T2 disability level. After accounting for Block 1 variables, higher belief that one was capable of performing chronic pain management strategies, as measured by the CPSS at baseline, was related to lower disability levels as measured by the ODIv2 at one-month follow-up (see Table 12). Subscales indicating the degree of internal or external HLOC at baseline were not related to level of disability at follow-up.

See Table 13 for a summary of the regression analysis with self-rated physical health as measured by the PCS as the criterion variable. In Block 1, T0 PCS scores were significantly positively predictive of T2 PCS scores. After accounting for T0 PCS, age, and gender in Block 1, CPSS scores were uniquely predictive of T2 PCS in Block 2.

Table 12. Hierarchical Regression Analysis for Prediction of Disability Level

Criterion	Predictors	β	F	R^2	$Adj.\ R^2$	ΔR^2
ODIv2 (N = 58)						
Block 1			.31	.01	-.03	
	Age	.11				
	Gender	.02				
Block 2			10.78***			.45
	CPSS	.69***				
	IHLC	.04				
	CHLC	.03				
	DHLC	-.03				
Full Model			7.37***	.46	.40	

Note: Standardized β values listed. CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; ODIv2 = Oswestry Disability Index Version 2.

*p < .05, **p < .01, ***p < .001

Table 13. Hierarchical Regression Analysis for Prediction of Self-reported Physical Health

Criterion	Predictors	β	F	R^2	$Adj.\ R^2$	ΔR^2
PCS (N = 57)						
Block 1			5.32**	.23	.19	
	T0 PCS	.48***				
	Age	.19				
	Gender	-.07				
Block 2			4.33**			.20
	CPSS	.43**				
	IHLC	.17				
	CHLC	.18				
	DHLC	-.01				
Full Model			5.32***	.43	.35	

Note: Standardized β values listed. T0 = baseline; CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; PCS = Physical Component Scale.

*p < .05, **p < .01, ***p < .001

Thus, higher belief in one's ability to perform tasks of pain management at baseline predicted higher self-reported physical health at one-month follow-up. Subscales of the MHLC were not uniquely significantly related to T2 PCS scores.

Mental health outcomes

Evaluation of the relationship between T0 predictors (IHLC, CHLC, DHLC, and CPSS) and T2 mental health outcomes, as measured by the MCS and BDI-II, demonstrated a similar effect in both cases (see Tables 14 and 15). Specifically, follow-up values of both depression and self-reported mental health were significantly positively predicted by their scores at baseline. For each mental health variable, no individual variable in Block 2 (IHLC, CHLC, DHLC, or CPSS) was found uniquely predictive of T2 depression (BDI-II) or self-reported mental health (MCS).

Table 14. Hierarchical Regression Analysis for Prediction of Self-reported Mental Health

Criterion	Predictors	β	F	R^2	$Adj.\ R^2$	ΔR^2
MCS (N = 57)						
Block 1			7.45***	.30	.26	
	T0 MCS	.55***				
	Age	-.07				
	Gender	.15				
Block 2			1.82			.09
	CPSS	.24				
	IHLC	.08				
	CHLC	-.14				
	DHLC	.01				
Full Model			4.43**	.39	.30	

Note: Standardized β values listed. T0 = baseline; CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; MCS= Mental Component Scale.

**p* < .05, ***p* < .01, ****p* < .001

Regarding return to work, Table 16 lists frequency scores for each multi-dimensional level of employment as measured at one-month follow-up. The impact of predictor variables (IHLC, CHLC, DHLC, and CPSS) on return to work (RTW) at one-month follow-up was evaluated using a logistic regression with the dichotomous RTW variable as the criterion variable (0 = unemployed; 1 = employed). As with previously performed regression analyses, age and gender were entered into the first block and predictor variables were entered in the second block. No variables in either block were predictive of return-to-work one month following the end of treatment (see Table 17).

Table 15. Hierarchical Regression Analysis for Prediction of Depression Level

Criterion	Predictors	β	F	R^2	$Adj. R^2$	ΔR^2
BDI-II (N = 54)						
Block 1			11.28***	.40	.37	
	T0 BDI-II	.62***				
	Age	-.09				
	Gender	-.02				
Block 2			.65			.03
	CPSS	-.17				
	IHLC	-.01				
	CHLC	.00				
	DHLC	-.12				
Full Model			5.07***	.44	.35	

Note: Standardized β values listed. T0 = basline; CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; BDI-II = Beck Depression Inventory - II.

*p < .05, **p < .01, ***p < .001

Table 16. Descriptive Statistics for Return to Work at One-month Follow-up

	Frequency	Percent
Return to Work (Multi-level; *N* = 58)		
Unemployed	13	22
Training or change in employment	5	9
New position with same employer	0	0
Modifications to previous employment	19	33
No change in employment	21	36

Table 17. Logistic Regression Analysis for Prediction of Return to Work

Criterion	Predictors	β	*p*	R^2*	ΔR^2*
RTW (*N* = 58)					
Block 1				.01	
	Age	-.03	.42		
	Gender	-.12	.85		
Block 2				.06	.05
	CPSS	.01	.13		
	IHLC	-.06	.27		
	CHLC	-.05	.56		
	DHLC	.02	.90		

Note: Unstandardized β values listed. RTW = return to work; CPSS = Chronic Pain Self-efficacy Scale, IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals.

* Cox & Snell *R*-square values used as an estimate of *R*-square.

Research Question 3

Do intervention-related changes in predictors (health locus of control and pain-related self-efficacy) from baseline to the end of treatment predict physical outcomes (lift, return to work, disability, and self-reported physical health) and mental outcomes (self-reported physical health and depression) one month post-intervention?

Due to low *N*, in combination with the limited variance typically associated with change scores, the potential power for regression analyses examining this question was expected to be very low, with a high likelihood of Type 2 error. Therefore, this question was examined in an exploratory fashion using correlational analyses to maximize the probability of finding relationships between change scores and outcome variables, if present. This correlation matrix included two main categories of variables: (1) changes in predictor variables (IHLC, CHLC, DHLC, and CPSS) from T0 to T1, and (2) outcome variables (floor-to-waist lift, ODIv2, RTW, PCS, MCS, and BDI-II) measured at T2. The primary intent of examining these correlations was to determine whether treatment-related changes in predictor variables were related to physical and mental health outcomes measured at one-month follow-up. As shown in Table 18, no significant correlations were demonstrated between treatment-related change in predictors (from T0 to T1) and physical and mental health outcome variables (measured at T2).

Table 18. Correlations of Change in Predictors from T0 to T1 with Outcomes at T2

Outcome:	Lift	ODIv2	PCS	MCS	BDI-II	RTW
Predictor						
Δ CPSS	.21	.22	.04	.17	.01	.15
Δ IHLC	.09	.01	-.18	.17	.00	.06
Δ CHLC	.03	.05	.05	-.13	-.14	-.14
Δ DHLC	.03	.03	.08	-.23	.16	-.07

Note: For RTW (return to work), 0 = unemployed and 1 = employed. CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance health locus of control; DHLC = health locus of control for medical professionals; Lift = floor-to-waist lift score; BDI-II = Beck Depression Inventory - II; PCS = Physical Component Scale; MCS = Mental Component Scale.

Summary

Individuals who participated in the Spine Center's two-week rehabilitation program experienced treatment-related changes in predictor variables (MHLC and CPSS). That is, participants experienced increased IHLC and decreased CHLC from the beginning of treatment to discharge. Participants in the program also demonstrated treatment-related increase in CPSS scores. All changes remained significant at one-month follow-up. Regarding physical and mental health outcomes, patients experienced improvements on all measures that were administered at T0, T1, and T2, and improvements were maintained at one month.

Regression analyses indicated significant prediction of T2 lift scores by CPSS, IHLC, CHLC, and DHLC. Specifically, higher levels of pain-related self-efficacy, internal HLOC, and chance HLOC, and lower levels of doctor HLOC at baseline predicted higher lift scores one month following the spine rehabilitation program. Additionally, higher baseline self-efficacy predicted lower levels of disability and higher self-rated physical health at one-month follow-up. Return to work, self-reported mental health, and depression level were not significantly predicted by baseline CPSS or MHLC scores. Correlational analyses did not demonstrate relationships between treatment-related change in CPSS scores or MHLC subscale scores and physical and mental health outcomes.

CHAPTER 5

DISCUSSION

This chapter will discuss how findings of the current study expanded upon previous knowledge related to the constructs of HLOC and pain-related self-efficacy in the context of MI for chronic back pain. It will begin with a discussion of the findings related to HLOC and treatment-related change in HLOC, connecting current results to those found in previous studies. The chapter will then discuss results related to pain-related self-efficacy and change in self-efficacy as a result of MI. These findings will be interpreted and connected to literature on the self-efficacy construct as measured in pain patients. Finally, the chapter will summarize limitations of the current study. Implications for practice and research follow, and the chapter ends with a summary of overarching conclusions based on the current study.

Health Locus of Control

The current study sought to extend the literature regarding HLOC by examining the predictive relationship between pre-treatment HLOC and post-treatment physical and mental health outcomes following MI for chronic back pain. Regression analyses that controlled for baseline relationships between HLOC and outcome measures allowed interpretation regarding the predictive relationship between HLOC and physical and mental health variables. Thus, relationships demonstrated between baseline HLOC subscales and follow-up outcome measures were considered to suggest a potential relationship in which level of HLOC subscales contributed in a linear fashion to the level of outcome variables measured one month following treatment.

Patients who began the spine rehabilitation program with higher internal HLOC at baseline were able to lift heavier weights from floor-to-waist at follow-up than those who had lower IHLC. This finding aligns with the tenets of SLT, which indicates that individuals are more likely to perform a behavior when they believe their behavior is likely to impact their pain directly. It appears that individuals in the spine rehabilitation program with higher IHLC may have been more likely to engage in behaviors encouraged by the treatment program, which resulted in better lift scores after treatment.

Controlling for baseline lift scores in this analysis indicated that the relationship between baseline IHLC and follow-up lift scores was not merely a result of a correlation that already existed between IHLC and lift scores at the outset of the program. Thus, in terms of functional capacity, chronic pain patients who entered the program with higher internal expectancies for control of their pain were more likely to demonstrate benefit from MI than those who had less internal expectancies for pain control. Previous research that showed a relationship between IHLC and better physical outcomes was solely cross-sectional in nature and primarily with groups other than chronic back pain patients. Therefore, this finding extends research in the area of HLOC by demonstrating a positive, predictive relationship between IHLC and functional capacity in back pain patients, a population with whom little exploration of the effects of HLOC has been examined.

Higher CHLC at baseline was predictive of higher lift scores at one-month follow-up, which was not expected in the context of SLT. Based in SLT, individuals with external expectancies for the control of their pain would be less likely to engage in proactive pain management behaviors due to the low perceived likelihood that the behaviors would lead to pain reduction. This decreased engagement in pain management would, in turn, likely lead to poorer outcomes from a rehabilitation program that requires pain management behaviors on the part of patients. Therefore, a high level of baseline CHLC should theoretically predict lower functional capacity at follow-up, due to decreased investment in the behaviors required of the spine rehabilitation program. Although previous studies have demonstrated correlational relationships between higher CHLC and lower physical and mental functioning, it is possible that the current study's use of longitudinal regression analyses has elucidated a previously unknown predictive relationship between higher baseline CHLC and better outcomes following treatment. It is possible that higher chance expectancies for control of chronic back pain allow individuals to become more accepting of the unpredictability of their pain and more able to engage fully in the treatment process. This theoretically incongruent finding requires further examination in future studies, due to limited literature regarding the relationship between CHLC and outcomes following MI for chronic back pain populations.

Entering the treatment program with an external expectancy of pain management directed toward medical professionals (i.e., DHLC) was related to lower functional capacity one month following treatment. Inclusion of baseline lift score as a control variable indicates that this relationship between baseline DHLC and follow-up lift score was not due solely to a correlation between the two variables that existed at baseline. That is, this regression analysis suggests a linear relationship between DHLC and functional capacity, such that entering a MI program with higher DHLC predicted lower likelihood of benefiting from the program in terms of functional capacity. This finding aligns with expectations within the context of SLT. Specifically, SLT would posit that individuals with higher expectancy of pain control by medical professionals, i.e., those with higher external health locus of control, would be less likely to engage in pain self-management behaviors due to more perceived benefit from intervention by medical professionals. These individuals, in turn, would be less likely to benefit from treatment that emphasized self-management strategies. This theoretical expectation based in SLT was supported in the current study. This finding also aligns with previous research that has indicated a correlation between higher powerful others HLOC and lower desire for control of the healthcare delivery process (Wallston & Wallston, 1982), and extends the understanding of this relationship by demonstrating a more linear relationship between baseline DHLC and follow-up functional capacity. It does not, however extend previous findings that demonstrated more adherence to medical recommendations by individuals with higher HLOC for powerful others. Future studies may benefit from inclusion of a variable that assesses the extent to which individuals engaged in particular behaviors (e.g., aerobic exercise, relaxation, lifting weights) throughout the rehabilitation program, to provide more understanding of the mechanism of the relationship between DHLC and physical outcomes.

Pre-treatment scores on subscales of the MHLC were not found predictive of self-reported disability level or improved self-reported physical health one month following the spine rehabilitation program. This finding does not provide support for the expected relationship between HLOC and overall physical functioning based in SLT. If the relationship between HLOC and broad physical functioning following MI does not exist, it would appear that higher internal HLOC and lower external HLOC do not facilitate the range of rehabilitation behaviors required to lead to generally improved physical abilities. Alternatively, due to the inclusion of all predictors in the analysis, it is possible that a strong relationship between pain-related self-efficacy and disability level led to the CPSS accounting for such a substantial portion of the variance in disability level and physical health that relationships between MHLC subscales and disability were not significant. This possibility would support the suggestion of Luszczynska and Schwarzer (2005) that self-efficacy is a potentially stronger predictor of health outcomes than HLOC, although the current study's findings regarding lift scores would suggest stronger prediction by self-efficacy does not occur across all types of health outcomes. A third possible explanation is that the sample size for this analysis was simply too low to produce enough power to detect an existing relationship between baseline HLOC and follow-up disability level or self-reported physical health.

Another surprising finding was the lack of a predictive relationship between baseline HLOC and follow-up measures of depression and general mental health. This finding was unexpected in light of previous research that has found relationships between HLOC and mental health variables (e.g., Wallston & Wallston, 1982, Bonetti et al., 2001). Importantly, these previous studies were cross-sectional in nature. Thus, findings in the current study suggest that the correlation between HLOC subscales and mental health that has been demonstrated in previous research may not be best interpreted as an indication that HLOC leads to worse outcomes in mental health. It appears equally if not more likely that depression or lower mental health functioning lead to less internal and more external HLOC, or, alternatively, that a third variable such as low physical functioning leads to both. Overall, it appears possible that HLOC is not predictive of mental health outcomes following MI for chronic back pain beyond correlational relationships with mental health that already exist before treatment. It is possible, however, that low sample size created too low power to detect relationships between the predictor variables and mental health outcomes in these analyses.

The finding that HLOC subscales did not predict return-to-work requires further examination in future studies, as the number of unemployed individuals in the current study (only thirteen) likely created power that was too low to detect difference between employed and unemployed individuals related to pre-treatment HLOC. Additionally, follow-up at one month after intervention may be too soon to indicate differences that may become clearer months after treatment. Further examination of the relationship between pre-treatment HLOC and post-treatment return-to-work, with larger sample size, will be important in providing additional understanding of the predictive value of the HLOC construct.

The current study provides a number of important results to facilitate increased understanding of the relationship between HLOC and physical and mental health variables. That is, higher internal HLOC and lower HLOC toward medical professionals may lead to better functional capacity following MI for chronic back pain. Higher chance HLOC may also predict higher functional capacity at follow-up, although this finding requires further examination due to its incongruence with tenets of SLT. The HLOC construct did not appear particularly valuable in predicting broad indicators of disability or physical health, and it was also not predictive of mental health outcomes. Perhaps larger sample sizes and increased power would have led to different findings. Alternatively, it is possible that HLOC has limited value as a predictor of health behavior unless combined with other constructs such as self-efficacy, as mentioned by AbuSabha and Achterberg (1997) and Luszczynska and Schwarzer (2005). It is also possible that the correlation that has been found between HLOC and mental health outcomes may be explained more effectively by examining the prospective impact of mental health on HLOC, or by studying the possible mediational effects of other factors, such as physical functioning, on HLOC and mental health.

Altering HLOC

The current study also sought to extend the literature regarding HLOC by examining the impact of MI for chronic back pain on subscales of the MHLC. The increase in IHLC aligns with what we might expect within SLT, given the focus of the rehabilitation program on patients managing their own pain and in expanding patients' repertoire of pain management strategies. That is, it appears likely that a rehabilitation program that emphasizes self-management of pain would increase the expectancy that one's pain is due to internal factors, such as the extent to which one participates in regular exercise. It is unclear, however, whether the increase in IHLC would have continued over time, in light of the finding the IHLC dropped significantly in the month following treatment. It is also important to note that the lack of an experimental control group precludes the ability to conclude with certainty that the treatment program itself caused the changes in IHLC. It is also not possible to determine whether any components of the spine rehabilitation program were stronger contributors to change in IHLC than others.

Chance HLOC also demonstrated treatment-related change in the expected direction, decreasing from pre-treament to post-treatment. This decline remained significant at one-month follow-up, without a discernable change from the end of the program to one month later. This finding supports that participation in MI for chronic back pain may lead to less belief that chance factors are responsible for one's pain. It is possible that a rehabilitation program such as the Spine Center's program clarifies the factors contributing to pain to the extent that patients more realistically understand the impact of non-chance factors, such as limited exercise or poor posture. Applying concepts of SLT, the two-week rehabilitation program likely led to decreased perceived connection between chance factors (e.g., bad luck) and health-related reinforcements (e.g., lowered pain levels). Again, the lack of a control group precludes the ability to conclude with certainty that the spine rehabilitation program caused the change in CHLC. It is also not possible to determine which, if any, components were more valuable in leading to this change.

The expectancy that medical professionals were responsible for health status (i.e., DHLC) was not significantly impacted by MI in this study. This finding was not necessarily expected, due to the general goal of rehabilitation to empower patients to take responsibility for their pain management and to rely less on medical procedures. It is, however, interesting to consider that utilizing the strategies provided in a chronic pain rehabilitation program may require a great deal of belief in the ability of the medical professionals on the treatment team to provide helpful interventions. Thus, individuals may experience increased internal expectancies for control of their pain without necessarily abandoning their expectancies related to the impact of medical professionals on their pain. In other words, this finding may exemplify a case in which increased internal HLOC does not necessarily imply decreased external HLOC, at least with respect to the influence of medical professionals.

Overall, these findings suggest that MI for chronic pain has the ability to increase IHLC and to decrease CHLC. These findings support extant literature indicating that MI for back pain leads to change in HLOC beliefs, although it was not supported with a measure of external HLOC specific to medical professionals. It is possible that DHLC is less likely to change in a program that requires patients to follow the recommendations of medical professionals, even if following these recommendations leads to more patient responsibility in pain management. As with Rybarczyk et al. (2001), the current study was not able to provide further knowledge regarding specific components of MI that contribute to the changes in CHLC and IHLC. Additionally, it is important to consider the small sample size when interpreting results of the study, and to take appropriate caution before generalizing the results to other groups.

Findings of the current study did not indicate a correlational relationship between treatment-related change in HLOC and mental or physical outcomes as measured at one-month follow-up. It is possible that absolute levels of HLOC subscales are more valuable than their treatment-related change in predicting benefit from MI for chronic pain. It is also possible that the low variance in change scores precluded the ability for these analyses to detect any relationship that existed between treatment-related change in the predictor variables to post-treatment physical and mental health. Further examination of the impact of change in HLOC on outcomes with larger sample size may be important to provide information regarding the utility of specifically targeting HLOC in treatment programs.

Self-Efficacy and Back Pain

The current study sought to examine the predictive relationship between pre-treatment pain-related self-efficacy and post-treatment physical and mental health outcomes following MI for chronic back pain. By controlling for baseline levels of each outcome variable in longitudinal regression analyses, it was hoped that the current findings would extend what is already known about pain-related self-efficacy based on cross-sectional correlations previously reported in the literature.

Individuals who entered the treatment program with higher belief in their ability to perform tasks of pain management (i.e., higher pain-related self-efficacy) were able to lift heavier loads from floor-to-waist at one-month follow-up than those who entered the program with lower belief in their pain-management abilities. Controlling for baseline lift scores indicates that this finding was not due to a pre-treatment relationship between baseline pain-related self-efficacy and baseline lift scores. This finding supports expectations based on SCT, which would suggest that higher belief in one's ability to perform tasks of pain management (i.e., higher pain-related self-efficacy) would lead to improved performance in specific pain management tasks, such as lifting weights. This finding matches previous research by Estlander et al. (1994), in which pain self-efficacy predicted better physical function in tasks that targeted back muscles. It also matches several research studies that demonstrated a relationship between pain-related self-efficacy and functional capacity using correlational analyses. This finding extends previous research in the area by demonstrating a temporal relationship in which pre-treatment self-efficacy predicted post-treatment functional capacity after controlling for the baseline relationship between the variables. Although unknown variables may contribute to this finding, it appears that having higher pain-related self-efficacy predicts higher benefit from MI for chronic back pain in terms of functional capacity.

The current study also indicated that patients who entered the treatment with more belief in their ability to perform pain management strategies had lower disability levels after MI than those who had less belief in their ability to manage their pain. This finding supports expectations aligning with SCT. Based on SCT, higher self-efficacy for pain management would predict greater likelihood of engaging in pain management behaviors. In turn, those with higher self-efficacy would be likely to experience more benefit from a MI program that emphasizes self-management. Importantly, baseline scores on the ODIv2 were not available and thus were not included in this analysis. Thus, a temporal relationship is not distinguishable from this analysis, and it is possible that individuals who entered the program with both high pain-related self-efficacy and low disability levels simply maintained this relationship following treatment.

In support of SCT, patients who had higher belief in their ability to perform self-management tasks at baseline reported better physical functioning on the PCS one month following a MI program for chronic back pain than those who had lower belief in their pain management abilities. This analysis included baseline PCS as a control variable, to allow interpretation of the linear relationship between baseline pain-related self-efficacy and follow-up physical health. According to SCT, higher pain-related self-efficacy would predict increased likelihood of behaviors required for pain management. This hypothesis has been supported with previous research that found a relationship between higher pain-related self-efficacy and better performance on physical tasks, more maintenance of treatment benefits, and more effort in functional capacity evaluations. The current study extends previous research by providing evidence that pre-treatment pain-related self-efficacy may in fact lead to improved physical health reports one month following MI for chronic back pain.

Pain-related self-efficacy was not found predictive of return to work following MI for chronic back pain. As mentioned with regard to HLOC, it is likely that power was too low to detect any difference between employed and unemployed individuals related to pre-treatment pain-related self-efficacy. Additionally, measurement of return to work at a later date may have provided more information regarding differences in pre-treatment self-efficacy between those who had or had not returned to work. Further examination of the relationship between self-efficacy and return to work following MI for chronic back pain, utilizing a larger sample size, is indicated.

A relationship between baseline pain-related self-efficacy and follow-up mental health outcomes using the MCS and the BDI-II was not found. This finding appears very important in light of the fact that research regarding self-efficacy in pain patients has established correlational evidence that higher pain-related self-efficacy is related to better mental health in pain patients (Turk & Okifuji, 2002). This finding, however, has not been demonstrated specifically in back pain patients where the focus has been on the relationship between pain-related self-efficacy and physical outcomes. Similar to previous research, the current study indicated a correlational relationship between higher pain-related self-efficacy and better mental health on the MCS and the BDI-II at baseline. When this relationship was assessed prospectively using a regression including baseline pain-related self-efficacy and one-month MCS and BDI-II scores, controlling for pre-treatment measurements of the outcome variables, pain-related self-efficacy did not predict post-treatment depression or mental health reports. Thus, the correlation between self-efficacy and mental health established in the literature must not be interpreted as an indication that higher pain-related self-efficacy causes better mental health.

Based in SCT, higher pain-related self-efficacy would predict more willingness to engage in activities geared toward management of pain. Due to the inclusion of coping with pain as one subscale on the CPSS, it is surprising to find that mental health was not predicted by baseline levels of pain-related self-efficacy. It is possible, however, that change in mental health is a precursor to change in self-efficacy, or that a third variable such as physical health status leads to changes in both. These relationships would benefit from further examination in future research studies, to provide greater understanding of the mechanism underlying correlations between pain-related self-efficacy and indices of mental well-being.

The current study provides increased understanding of the relationship between pain-related self-efficacy and physical and mental health outcomes following MI for chronic back pain. Specifically, this study furthered the research regarding relationships between pain-related self-efficacy and several physical health variables by providing evidence of pre-treatment self-efficacy as a predictor of function following treatment after controlling for pre-treatment correlation between the variables. Thus, interpretation of a causal relationship between self-efficacy and improved physical outcomes is supported by the findings of this study, which was not the case in previous literature demonstrating cross-sectional correlational relationships only. In contrast, pain-related self-efficacy was not found predictive of return to work, which may be related to the small sample size. Pain-related self-efficacy also did not predict mental health outcomes.

It is possible that the correlational relationship between these variables found in previous studies is due to a mediational variable, or due to the prospective impact of mental health on self-efficacy beliefs. Due to small sample size, these findings would benefit from further examination in future studies.

Altering Pain-Related Self-Efficacy

To provide additional understanding of the self-efficacy construct in back pain patients, the current study examined the impact of MI for chronic back pain on pain-related self-efficacy. Chronic pain self-efficacy demonstrated treatment-related change in the expected direction, as it increased from baseline to the end of the two-week rehabilitation program, and the increase remained significant one month following the program. Thus, MI for chronic back pain appeared to increase patients' belief in their ability to perform tasks required for pain management. This increase in self-efficacy was most notable immediately following treatment, after which a significant decline occurred before one-month follow-up. Thus, MI for chronic back pain demonstrated ability to increase pain-related self-efficacy to a significant degree within two weeks, and improvements remained one month later but at a significantly lower level than the end-of-treatment level. This result matches Kool et al.'s (2005) finding that a chronic pain rehabilitation program requiring increased physical activity led to increase in pain-related self-efficacy. It is unclear whether self-efficacy would have remained significantly higher than baseline as time progressed after treatment.

Due to the lack of a control group that did not receive the same treatment, it is not possible to conclude with certainty that changes in self-efficacy were produced by the MI program. Additionally, it is not possible to determine which components of the spine rehabilitation program, if any, contributed more to change in self-efficacy than other components. Nicholas and colleagues (1992) found cognitive-behavioral intervention an essential component leading to treatment-related changes in pain-related self-efficacy. Aligning with this finding, the Spine Center's treatment includes a substantial cognitive-behavioral component. Further research into specific components of treatment that may impact self-efficacy would be beneficial to assist in maximizing cost-effectiveness.

Change in pain-related self-efficacy from baseline to discharge did not predict mental or physical outcomes measured at one-month follow-up. It is possible that absolute baseline degree of pain-related self-efficacy is more valuable in predicting post-treatment outcomes than treatment-related change in self-efficacy. It is also possible that low power precluded the ability to detect correlational relationships between change in self-efficacy and follow-up levels of physical and mental health. In light of findings by Altmaier and colleagues (1993) that treatment-related change in self-efficacy was not predictive of changes immediately following treatment, but predicted maintenance of treatment benefit six months following treatment, it is possible that differences would have emerged after more time elapsed following the spine rehabilitation program. In light of small sample size in the current study, further examination of the relationship between pain-related self-efficacy and outcomes following MI for chronic back pain is warranted.

Multidisciplinary Intervention for Chronic Back Pain

This study provides further evidence that MI for chronic back pain leads to positive outcomes across multiple dimensions. The lack of a control group, however, precludes the ability to conclude that changes following MI were definitely a result of the program and not due to other factors such as time or daily interaction with medical professionals. Importantly, this type of treatment may not reduce the degree to which medical professionals are viewed as responsible for assisting patients in managing their pain. These findings reinforce the benefits of MI for chronic back pain, as individuals not only subjectively rated their physical health as significantly improved, they also demonstrated increased functional capacity measured objectively through floor-to-waist lift scores. Furthermore, patients who participated in this MI program rated their mental health as significantly improved at the end of the group, with changes maintained one month later. They also demonstrated significant decrease in depression levels that extended to one-month follow-up. Overall, these findings point to the overall positive impact of MI for chronic pain in both physical and psychological domains.

Limitations

A number of limitations require attention when interpreting the results of the current study. First, due to time constraints and lower then predicted numbers of individuals attending follow-up appointments, this study had a smaller sample size than was initially desired. Additionally, some participants failed to complete all questionnaires administered, typically due to an error such as missing a full page of items before returning their forms by mail. Thus, in order to maximize N in each analysis, data were used for all participants who completed at least some of the administered instruments at all time points. Therefore, sample size was variable across analyses, leading to slight variations in the participants included in separate analyses.

An additional methodological limitation of the current study was the variation in time from end of treatment to completion of one-month follow-up measures. Although most individuals attended follow-up appointments within five weeks of the end of treatment, some follow-up measures were completed by mail and, due to lapse in mailing time, the actual date of completion of the mailed measures was unclear and in some cases may have varied considerably from the one-month follow-up time point.

Although the use of timewise regression analyses in the current study may provide new information regarding the predictive value of HLOC and pain-related self-efficacy for chronic back pain, it must be noted that this study was not performed in an experimental fashion. That is, no comparison control group was used in the current study. Therefore, the relationships demonstrated between predictor variables and outcomes may reflect the effect of an unknown variable that was not included in the regression analyses. Care must be taken when interpreting the findings of these analyses, and replication with control group comparisons may provide more conclusive results.

A significant gap in the literature that was not addressed in this study concerns the lack of attention to cultural differences in HLOC or self-efficacy. It is not clear how or whether these constructs apply to racially or ethnically diverse individuals, due to little research with non-white patients and little theoretical attention to diverse populations. The constructs of HLOC and self-efficacy are based in theories dating back to a time when research focused primarily on white, middle-class research participants. It is possible that individuals from minority backgrounds or those of low socioeconomic status, who have experienced repeated instances in which powerful others have exerted control over them, are more likely than others to have external expectancies of control. Furthermore, experiences of racism or classism may lead to lower self-efficacy in diverse populations.

Furthermore, research supporting the efficacy of MI for back pain either does not include diverse samples, or does not mention ethnic and socioeconomic background of participants. Additionally, while current researchers tend to strive for equal inclusion of diverse participants in research studies, differential access to healthcare means that current research in the area of healthcare and treatment efficacy is biased toward inclusion of middle-class, white patients. Due to the fact that participants were recruited in a healthcare setting in a location with relatively low levels of racial and ethnic diversity, this study did not examine these factors appropriately. Therefore, it is important that future research attempt to elucidate cultural similarities and differences when using these constructs to predict outcomes, or when trying to change patients' HLOC or self-efficacy. Care must be taken in attempting to generalize these findings to ethnically and racially diverse groups.

Future Implications

Practice implications

This study supports the utility of assessing pain-related self-efficacy and HLOC to assist in formulating an understanding of which patients are most likely to benefit from MI for chronic back pain. It appears both factors are relevant when predicting benefit in terms of an objective measurement of functional capacity, i.e., lift scores. Self-efficacy for chronic pain management, as measured by the CPSS, demonstrated predictive value for objective measurement of functional capacity as well as subjective ratings of disability and physical health. Knowing that individuals with higher internal HLOC, lower HLOC for medical professionals, and higher pain-related self-efficacy are likely to benefit more from treatment in terms of functional capacity offers evidence that it may be beneficial to assess these variables as part of an initial assessment for MI.

With knowledge of pre-treatment scores on the MHLC and the CPSS, treatment may be altered to provide alternative methods of encouragement to engage in treatment for those who are not prone to attempt pain management behaviors. That is, individuals with lower pain-related self-efficacy may benefit from extra encouragement to extend beyond their perceived limits. Individuals with less internal HLOC, and more expectation of control by medical professionals may benefit from more education about the direct relationship between their behaviors and positive treatment outcomes. They may also benefit from alternative modes of reinforcement for pain-management behaviors, possibly increasing the amount of external reinforcement provided to increase their likelihood of engaging in treatment (e.g., token economies). In some cases, when predictive factors indicate especially low likelihood of benefiting from MI, it may be appropriate to recommend alternative treatments before participating in what is likely to be a costly intervention. For instance, programs that provide education about the nature of back pain and potentially raise IHLC and lower CHLC, or physical therapy interventions that increase patient perceptions of ability to perform physical tasks, may be more appropriate than having these individuals enter a treatment program that is unlikely to provide benefit. The finding that higher chance HLOC was predictive of better functional capacity requires further examination due to its contradiction to previous research and expectations within the context of SLT.

It appears important to refrain from placing too much emphasis on the predictive value of HLOC alone, as self-efficacy demonstrated relationships with both objective and subjective domains of physical function whereas HLOC was only predictive of objectively measured functional capacity. Additionally, this study supports using HLOC and pain-related self-efficacy to predict physical outcomes of MI for chronic back pain, but it does not support using these variables to predict mental health outcomes. Thus, measurement of self-reported mental health and depression scores also appear important to include in pre-treatment assessment. Overall, the combination of clinical judgment and pre-treatment assessment of chronic pain self-efficacy, HLOC, depression, and self-reported mental health status may offer useful information in predicting patients who may benefit physically and mentally from MI for chronic back pain. Knowledge of these factors may assist in adequately accommodating patients on an individual basis through varied types of motivation and encouragement to engage in treatment-related behaviors. In some cases, referral to other, more appropriate treatment, may be beneficial when low likelihood of benefiting from MI is predicted.

Although referral to other treatment may be appropriate, it is important to use other clinical factors in addition to HLOC and self-efficacy when considering the potential for individuals to benefit from MI for back pain. When patients have the potential to benefit from MI, this service must not be denied unnecessarily. On the other hand, it may be appropriate to refer patients to alternative treatments or to provide alternatives to MI. Such alternatives may include psychoeducational or efficacy-promoting components while potentially preparing patients to benefit more from MI in the future. Such referral parallels the practice of referring patients with addictions to substance abuse treatment before providing MI for chronic pain, due to the limited likelihood of benefiting from treatment while actively abusing substances. While denial of a potentially beneficial service is not a general recommendation, it is also important to consider the potential costs of providing treatment that may lead to little benefit under certain circumstances.

When the HLOC and pain-related self-efficacy constructs are used to assist in prediction of outcome following MI, it will be crucial for practitioners to discuss responses on the measures with patients. Discussion of the responses may allow understanding of potential cultural factors impacting scores, and it may promote the ability to provide feedback and psychoeducation. For instance, clinicians may inform patients of the potential benefits of increasing their belief in their ability to manage pain, providing patients with research findings such as those in the current study. Additionally, it may be beneficial to inform patients of the potential impact of their level of internal versus external HLOC on their benefit from the program. Patient awareness of these factors may promote more self-involvement in the process of attending to self-efficacy and locus of control with regard to engagement in a rehabilitation program.

Due to the limited inclusion of culturally diverse individuals in the current sample, it is important that practitioners refrain from assuming the results of this study will generalize to diverse populations. Individuals' beliefs regarding the factors impacting their pain, and their ability to perform behaviors associated with their pain, are likely to have culturally-bound meaning that will be important for practitioners to understand. For example, in cultures emphasizing the importance of culturally traditional healing practices outside the mainstream healthcare system, the HLOC construct may include a dimension completely outside the dimensions assessed with subscales of the MHLC. Furthermore, it may be inadvisable to strive to increase IHLC in individuals whose culture places high value on collectivism and the importance of community and family involvement in supporting and promoting the health of community members. Thus, it will be important for clinicians to remain open to altering their understanding of the HLOC and self-efficacy constructs and to openly examine and discuss potential divergence of patient presentations from what may be expected based on the results of the current study.

Interpretation of the current results must be considered within the context of the specific type of treatment provided within the UI Spine Center's spine rehabilitation program. As outlined in Appendix A, the UI Spine Center involves a variety of treatment modalities in an interdisciplinary format. Thus, the predictive value of HLOC and pain-related self-efficacy in the current study reflects treatment-related change in the context of a specific interdisciplinary treatment program. These predictive relationships may not be present in treatments that place less emphasis on patient engagement across an array of pain management dimensions. Thus, results of the current study support the use of the MHLC and CPSS as screening instruments for programs that involve an interdisciplinary treatment approach such as that provided in the UI Spine Center.

Research implications

The current study provided increased understanding of the relationship between two psychological predictors, pain-related self-efficacy and HLOC, and mental and physical health outcomes following MI for chronic back pain. Specifically, use of regression analyses across time, while controlling for baseline relationships between variables, allowed interpretation of these relationships beyond correlational relationships that may have already existed at baseline. More remains to be learned through future research. Importantly, replication of the current findings is essential due to small sample size and unexpected results regarding the relationship between CHLC and lift scores, and regarding the lack of predictive value of HLOC and pain-related self-efficacy on mental health outcomes. Additionally, it may be beneficial to specifically design a study to examine the hierarchical relationship between self-efficacy and HLOC in predicting variables for which HLOC did not appear predictive in this study (self-reported mental health and disability level).

Future research may also compare scores on instruments such as the MHLC and CPSS to clinician ratings of the extent to which they perceive patients as presenting with internal and external HLOC and pain-related self-efficacy. A comparison of clinical judgment to patient report on these measures may facilitate greater ability to conceptually apply the results of studies such as the current study to clinical practice. Future research may also include additional measures to maximize prediction of outcomes from MI, such as personality traits or self-reported mental health. Finally, replication of the current study with greater time between the end of treatment and the measurement of follow-up functioning would provide more information regarding the duration of relationships noted in the current study.

Due to the interdisciplinary nature of the Spine Center's treatment program, it is possible that outcomes would be different with other types of MI for chronic back pain. Thus, future research would benefit from comparison between interdisciplinary and non-interdisciplinary programs that provide multidisciplinary approaches to chronic pain management. This research may elucidate the necessary components to achieve the positive results found in the current study.

Conclusions

The results of the current study provide consistent evidence that MI for chronic back pain is beneficial across a number of physical and mental health domains. The results also offer evidence that self-efficacy and HLOC may be helpful constructs to assist in predicting which patients are most likely to benefit from MI for chronic back pain. Individuals with higher internal HLOC and lower DHLC were more likely to experience improvements in objectively measured functional capacity after participating in a spine rehabilitation program emphasizing pain self-management strategies. These findings aligned with expectations within SLT, suggesting that individuals with more internal and less external beliefs regarding control of their pain were likely to experience more improvement in lift capacity than those with higher internal and lower chance HLOC. In terms of HLOC for chance factors, however, this study demonstrated findings that were incongruent with expectations within SLT. That is, higher CHLC was predictive of higher lift scores one month following rehabilitation. Additionally, these findings were only found for lift scores, and they did not transfer to self-reported disability, physical health outcomes, mental health outcomes, or return to work. Further exploration of these relationships is in order in chronic pain populations.

This study extended previous research offering support for expectations within SCT that pain-related self-efficacy predicts more benefit from intervention for chronic back pain. Higher scores on the CPSS were related with higher functional capacity, lower disability, and better self-reported physical functioning measured one month following treatment. In contrast to other studies in this area, the results of the current study were longitudinal in nature, controlling for the effects of baseline relationships between predictors and outcomes. That, is predictive relationships were suggested by the relationship between baseline levels of pain-related self-efficacy and follow-up levels of physical health outcomes. This finding, however, was not demonstrated for mental health outcomes (depression and self-reported mental health) or return to work.

This study did not provide evidence of a relationship between treatment-related change in pain-related self-efficacy or HLOC and physical and mental health outcomes measured one month following treatment. It is possible that small sample size limited the ability to detect these relationships. Future research with larger sample size may be able to provide more conclusive evidence of the relationship between treatment-related changes in these psychological variables and treatments following MI intervention for chronic back pain.

Overall, this study provides evidence that HLOC and pain-related self-efficacy may be useful constructs to include in pre-treatment assessment of patients considering MI for chronic back pain. These variables may offer value in predicting individuals likely to benefit physically from a rehabilitation program for their back pain. Addition of instruments to measure mental health may offer the best predictive value for overall benefits from MI. Conducting assessment utilizing the MHLC and the CPSS may assist clinicians in developing appropriate interventions to encourage and motivate individuals to engage in the rehabilitation progress to the greatest extent possible.

APPENDIX A

COMPONENTS OF THE TWO-WEEK SPINE REHABILITATION PROGRAM

Two-week Spine Rehabilitation Program

Functional restoration: Physical therapist guides patients in lifting, carrying, and other exercises to improve strength and balance. 15 hours.

Coping skills: A psychologist leads didactic groups that are cognitive-behaviorally based. Sessions cover a variety of topics including cognitive distortions, the gate-control theory of pain, and sleep hygiene. 11.5 hours.

Conditioning: Physical therapist guides patients performing aerobic exercises using treadmills, elliptical machines, bicycles, and stair-stepping machines. 10 hours.

Activity modifications: Physical therapist teaches the proper mechanics of sitting, standing, changing positions, rising from a sitting or lying position, and performing other daily activities. They also learn exercises to strengthen muscles used in daily activities. 10 hours.

Relaxation and Hypnosis: Psychologist or doctoral-level practicum student instructs on basic breathing techniques and learn a variety of hypnosis techniques. 8.5 hours.

Movement therapy: Physical therapist and patients follow a stretching and exercising video. 9 hours.

Vocational exploration: A vocational rehabilitation counselor gathers vocational information to help patients find new employment or re-enter their old positions. 4 hours.

Additional topics (1 hour each):

Welcome/expectations
Hurt versus harm
Wolf's law
Discussion with a former rehabilitation group member
Yoga
Tai Chi
Get Moving
Staying safe on the job
Understanding pain medications
Question and answer with the physiatrist

The Spine Team includes three licensed physical therapists, a licensed psychologist, a physiatrist, a vocational rehabilitation counselor, a program manager, and a doctoral-level psychology student.

Figure A1. Sample Schedule for the Two-week Spine Rehabilitation Program

8:00 am – 9:00 am	Movement Therapy
9:00 am – 10:00 am	Vocational Exploration
10:00 am – 11:00 am	Functional Restoration
11:00 am – 12:00 pm	Coping Skills
12:00 pm – 1:00 pm	Lunch
1:00 pm – 2:00 pm	Conditioning
2:00 pm – 2:30 pm	Functional Restoration
2:30 pm – 3:00 pm	Activity Modifications
3:00 pm – 4:00 pm	Relaxation Training

One-month Follow-up Appointments

Physiatrist evaluation: Each patient meets individually with the physiatrist for follow-up medical evaluation.

Functional capacity evaluation: Each patient is evaluated in terms of strength, using a variety of lift measures, and in terms of range of motion.

Cardiovascular evaluation: Cardiovascular performance is evaluated in a subset of patients requiring this testing at one month for worker's compensation or disability purposes.

Vocational rehabilitation: The vocational rehabilitation specialist meets with patients as desired.

Coping skills group: Patients are strongly encouraged to attend a one-hour support group to promote continued use of effective strategies for coping with pain and readjustment to family and work life following the rehabilitation program.

APPENDIX B

RETURN-TO-WORK QUESTIONNAIRE

Return-to-Work Measure

(To be completed at the end of treatment and 6 weeks, 3 months, 6 months and 1 year post rehabilitation)

Please read all of the following statements and place an "X" next to the ONE statement that applies best to your current employment situation.

1. __ I have returned to work at my **prior job, without modifications**, within the same company.

2. __I am **self-employed** and I have returned to my **usual job duties without modification**.

3. __ I **was previously enrolled as a student** and I am **currently taking classes** with the same course load as before.

4. __I am **retired** from work for **age-related** reasons.

5. __ I have returned to my **prior job**, with **some modifications**, within the same company.

6. __I am **self-employed** and I have returned to my **usual job duties with some modification.**

7. __I have begun working in a **new job, within the same company**, that is a **match for my current work restrictions.**

8. __ I have begun working at a **new job**, at a **new company**.

9. __ I am **actively training for a new job or returned to school.**

10. __I am currently **looking for employment**.

11. __I am **not employed**, I am **not retired for age-related reasons**, and I am **not looking for employment.**

APPENDIX C

DESCRIPTIVE STATISTICS FOR ALL PARTICIPANTS INITIALLY RECRUITED

Table C1. Demographics at Baseline, End of Treatment, and One-Month Follow-up

	Frequency			Percent		
Gender	T0	T1	T2	T0	T1	T2
Male	36	31	27	46	46	45
Female	42	36	33	54	54	55
Race						
Latino American	2	2	2	3	3	3
African American	1	1	1	1	2	2
Caucasian	75	63	57	96	95	95
Education						
Below H.S.	3	3	3	6	7	7
H.S. or GED	11	10	9	22	22	20
Some college or T.C.	21	21	20	43	46	45
College graduate	12	10	10	24	22	23
Master's degree	2	2	2	4	4	5
Relationship status						
Single	5	4	3	8	7	6
Cohabiting	1	1	1	2	2	2
Married	42	40	35	68	69	67
Divorced	12	12	11	19	21	21
Widowed	1	0	1	2	0	2
Separated	1	1	1	2	2	2

Note: Numbers for education and relationship status represent a subset of patients for whom this information was provided. T0 = baseline; T1 = immediately following

Table C1 – continued

treatment; T2 = one-month follow-up. H.S. = high school; GED = General Educational Development; T.C. = technical college.

Table C2. Descriptive Statistics

Variable	*N*	Range	Mean	Standard Deviation	Cronbach's α*
Age					
T0	71	22 – 72	46	12	
T1	67	22 – 72	46	12	
T2	60	28 – 72	48	11	
CPSS					
T0	70	60– 290	179	51	.96
T1	63	120 – 297	243	44	.96
T2	57	32– 300	212	64	.98
IHLC					
T0	71	7.2 – 36	22.65	5.84	.77
T1	64	13 – 36	27.28	5.59	.77
T2	58	6 – 36	24.93	7.35	.89
CHLC					
T0	71	6 – 26	15.00	4.93	.68
T1	64	6 – 23	12.13	4.81	.74
T2	58	6 – 27	13.11	5.00	.72
DHLC					
T0	71	5 – 18	11.28	2.94	.52
T1	64	3 – 18	10.33	3.74	.65
T2	58	6 – 18	11.43	2.96	.40
OHLC					
T0	71	3 – 15	8.58	2.50	.34
T1	64	3 – 11	6.28	2.50	.38
T2	58	3 – 13	6.28	2.68	.56
Lift Score					
T0	61	0 – 100	29.96	17.89	
T1	60	0 – 105	39.83	22.44	
T2	52	0 – 105	40.10	23.59	
BDI-II					
T0	67	0 – 53	17.58	10.80	.93
T1	66	0 – 31	6.50	6.55	.91
T2	57	0 – 37	8.37	8.95	.95
PCS					
T0	68	12 – 50	31.43	6.81	
T1	67	11 – 57	42.32	8.10	
T2	60	15 – 56	39.69	8.66	
MCS					
T0	68	10 – 63	40.00	13.57	
T1	67	12 – 65	48.66	11.85	
T2	60	7 – 66	46.44	13.25	
ODIv2					
T2	59	22 – 100	65.28	18.91	.91

Table C2 – continued

Note: T0 = baseline; T1 = end of treatment; T2 = one-month follow-up; CPSS = Chronic Pain Self-efficacy Scale; IHLC = internal health locus of control; CHLC = chance locus of control; DHLC = locus of control for medical professionals; OHLC = locus of control for others; Lift Score = floor-to-waist lift; BDI-II = Beck Depression Inventory - II; PCS = Physical Component Scale; MCS = Mental Component Scale; ODIv2 = Oswestry Disability Index version 2; and RTW = Return to Work.

REFERENCES

AbuSabha, R., & Achterberg, C. (1997). Review of self-efficacy and locus of control for nutrition- and health-related behavior. *Journal of the American Dietetic Association, 97*, 1122-1132.

Adams, M. A., Mannion, A. F., & Dolan, P. (1999). Personal risk factors for first-time low back pain. *Spine, 24,* 2497-2505.

Altmaier, E. M., Russell, D. W., Kao, C. F., Lehmann, T. R., & Weinstein, J. N. (1993). Role of self-efficacy in rehabilitation outcome among chronic low back pain patients*.* *Journal of Counseling Psychology, 40*, 1-5.

Anderson, K. O., Dowds, B. N., Pelletz, R. E., Edwards, W. T., & Peeters-Asdourian, C. (1995). Development and initial validation of a scale to measure self-efficacy beliefs in patients with chronic pain. *Pain, 63*, 77-84.

Arnau, R. C., Meagher, M. W., Norris, M. P., & Bramson, R. (2001). Psychometric evaluation of the Beck Depression Inventory-II with primary care medical patients. *Health Psychology, 20*, 112-119.

Arnstein, P., Caudill, M., Mandle, C. L., Norris, A., & Beasley, R. (1999). Self efficacy as a mediator of the relationship between pain intensity, disability and depression in chronic pain patients. Pain, 80, 483-491.

Asante, A. K., Brintnell, E. S., & Gross, D. P. (2007). Functional self-efficacy beliefs influence functional capacity evaluation. *Journal of Occupational Rehabilitation, 17*, 73-82.

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Bandura, A. (1997). *Self-efficacy: The Exercise of Control.* New York, NY: Freeman/Times Books/Henry Holt & Co.

Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on psychological science, 1*, 164-180.

Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. F. (1996). Comparison of Beck Depression Inventories- IA and -II in psychiatric outpatients. *Journal of Personality Assessment, 67*, 588-597.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory-II.* San Antonio, TX: Psychological Corporation.

Bonetti, D., Johnston, M., Rodriguez-Marin, J., Pastor, M., Martin-Aragon, M., Doherty, E., & Sheehan, K. (2001). Dimensions of perceived control: A factor analysis of three measures and an examination of their relation to activity level and mood in a student and cross-cultural patient sample. *Psychology and Health, 16*, 655-674.

Brox, J. I., Storheim, K., Holm, I., Friis, A., & Reikeras, O. (2005). Disability, pain, psychological factors and physical performance in healthy controls, patients with sub-acute and chronic low back pain: A case-control study. *Journal of Rehabilitation Medicine, 37*, 95-99.

Claiborne, N., Vandenburgh, H., Krause, T. M., & Leung, P. (2002). Measuring quality of life changes in individuals with chronic low back conditions: A back education program evaluation. *Evaluation and Program Planning, 25*, 61-70.

Conant, L. L. (1998). Psychological variables associated with pain perceptions among individuals with chronic spinal cord injury pain. *Journal of Clinical Psychology in Medical Settings, 5,* 71-90.

Cunha, I. T., Simmonds, M. J., Protas, E. J., & Jones, S. (2002). Back pain, physical function, and estimates of aerobic capacity. *American Journal of Physical Medicine Rehabilitation, 81*, 913-920.

Deyo, R. A., Battie, M., Beurskens, A. J. H. M., Bombardier, C., Croft, P., Koes, B., et al. (1998). Outcome measures for low back pain research: A proposal for standardized use. *Spine, 23*, 2003-2013.

Estlander, A., Vanharanta, H., Moneta, G. B., & Kaivanto, K. (1994). Anthropometric variables, self-efficacy beliefs, and pain and disability ratings on the isokinetic performance of low back pain patients. *Spine, 19,* 941-947.

Fairbank, J. C. T., & Pysent, P. B. (2000). The Oswestry Disability Index. *Spine, 22*, 2940-2953.

Feuerstein, M., Menz, L., Zastowny, T., & Barron, B. A. (1994). Chronic back pain and work disability: Vocational outcomes following multidisciplinary rehabilitation. *Journal of Occupational Rehabilitation, 4*, 229-251.

Gale, C. R., Batty, G. D., & Deary, I. J. (2008). Locus of control at age 10 years and health outcomes and behaviors at age 30 years: The 1970 British Cohort Study. *Psychosomatic Medicine, 70*, 397-403.

Gouttebarge, V., Wind, H., Kuijer, P., Sluiter, J. K., & Frings-Dresen, M. H. (2006). Reliability and agreement of 5 Ergo-Kit functional capacity evaluation lifting tests in subjects with low back pain. *Archives of Physical Medicine Rehabilitation, 87*, 1365-1370.

Gross, D. P., Battié, M. C., & Cassidy, D. (2004). The prognostic value of functional capacity evalutation in patients with chronic low back pain: Part 1. *Spine, 29*, 914-919.

Guzmán, J., Esmail, R., Karjalainen, K., Malmivaara, A., Irvin, E., & Bombardier, C. (2001). Multidisciplinary rehabilitation for chronic low back pain: systematic review. *BMJ, 23,* 1511-1516.

Härkäpää, K., Järvikoski, A., Mellin, G., Hurri, H., & Luoma, J. (1991). Health locus of control beliefs and psychological distress as predictors for treatment outcome in low-back pain patients: results of a 3-month follow-up of a controlled intervention study. *Pain, 46,* 35-41.

Heppner, P. P., & Heppner, M. J. (2004). *Writing and Publishing Your Thesis, Dissertation, & Research: A Guide for Students in the Helping Professions*. Belmont, CA: Brooks/Cole-Thomson Learning.

Hochhausen, N.M., Altmaier, E.M., McQuellon, R., Davies, S. M., Papadopolous, E., Carter, S., & Henslee-Downey, J. (2007). Social support, optimism and self-efficacy predict physical and emotional well-being after bone marrow transplantation. *Journal of Psychosocial Oncology, 25,* currently in press.

Kaplan, G. M., Wurtele, S. K., & Gillis, D. (1996). Maximal effort during functional capacity evaluations: An examination of psychological factors. *Archives of Physical Medicine and Rehabilitation, 77,* 161-164.

Katz, J. N. (2006). Lumbar Disc Disorders and Low-Back Pain: Socioeconomic Factors and Consequences. *Journal of Bone and Joint Surgery, 88,* 21-24.

Keller, A., Brox, J. I., & Reikerås, O. (2008). Predictors of change in trunk muscle strength for patients with chronic low back pain randomized to lumbar fusion or cognitive intervention and exercises. *Pain Medicine, 9*, 680-687.

Kool, J. P., Oesch, P. R., Bachmann, S., Knuesel, O., Dierkes, J. G., Russo, M., et al. (2005). Increasing days at work using function-centered rehabilitation in nonacute nonspecific low back pain: A randomized controlled trial. *Archives of Physical Medicine & Rehabilitation, 86*, 857-864.

Koumantakis, G. A., Watson, P. J., & Oldham, J. A. (2005). Trunk muscle stabilization training plus general exercise versus general exercise only: Randomized controlled trial of patients with recurrent low back pain. *Physical Therapy, 85,* 209-225.

Lackner, J. M., & Carosella, A. M. (1999). The relative influence of perceived pain control, anxiety, and functional self efficacy on spinal function among patients with chronic low back pain. *Spine, 24*, 2254-2261.

Lackner, J. M., Carosella, A. M., & Feuerstein, M. (1996). Pain expectancies, pain, and functional self-efficacy expectancies as determinants of disability in patients with chronic low back disorders. *Journal of Consulting and Clinical Psychology, 64*, 212-220.

Lanes, T. C., Gauron, E. F., Spratt, K. F., Wernimont, T. J., Found, E. M., & Weinstein, J. N. (1995). Long-term follow-up of patients with chronic back pain treated in a multidisciplinary rehabilitation program. *Spine, 20*, 801-806.

Lin, C., & Ward, S. E. (1996). Perceived self-efficacy and outcome expectancies in coping with chronic low back pain. *Research in Nursing & Health, 19,* 299-310.

Luszczynska, A., & Schwarzer, R. (2005). Multidimenstional Health Locus of Control: Comments on the Construct and its Measurement. *Journal of Health Psychology, 10*, 633-642.

Matheson, L. N., Isernhagen, S. J., & Hart, D. L. (2002). Relationships among lifting ability, grip force, and return to work. *Physical Therapy, 82*, 249-256.

Nicholas, M. K., Wilson, P. H., & Goyen, J. (1992). Comparison of cognitive-behavioral group treatment and an alternative non-psychological treatment for chronic low back pain. *Pain, 48*, 339-347.

Norlund, A., Ropponen, A., & Alexanderson, K. (2009). Multidisciplinary interventions: Review of studies of return to work after rehabilitation for low back pain. *Journal of Rehabilitation Medicine, 41*, 115-121.

O'Carroll, R. E., Smith, K. B., Grubb, N. R., Fox, K. A. A., & Masterson, G. (2001). Psychological factors associated with delay in attending hospital following a myocardial infarction. *Journal of Psychosomatic Research, 51,* 611-614.

O'Hea, E. L., Moon, S., Grothe, K. B., Boudreaux, E., Bodenlos, J. S., Wallston, K., & Brantley, P. J. (2009). The interaction of locus of control, self-efficacy, and outcome expectancy in relation to HbA1c in medically underserved individuals with type 2 diabetes. *Journal of Behavioral Medicine, 32*, 106-117.

Oberle, K. (1991). A decade of research in locus of control: what have we learned? *Journal of Advanced Nursing, 16,* 800-806.

Park, C. L., & Gaffey, A. E. (2007). Relationships between psychosocial factors and health behavior change in cancer survivors: An integrative review. *Annals of Behavioral Medicine, 34*, 115-134.

Patrick, L. E., Altmaier, E. M., & Found, E. M. (2004). Long-term outcomes in multidisciplinary treatment of chronic low back pain: Results of a 13-year follow-up. *Spine, 29*, 850-855.

Presson, P. K., & Benassi, V. A. (1996). Locus of control orientation and depressive symptomatology: A meta-analysis. *Journal of Social Behavior and Personality, 11*, 201-212.

Pucheu, S., Consoli, S. M., D'Auzac, C., Français, P., & Issad, B. (2004). Do health causal attributions and coping strategies act as moderators of quality of life in peritoneal dialysis patients? *Journal of Psychosomatic Research, 56,* 317-322.

Renemen, M. F., Brouwer, S., Meinema, A., Dijkstra, P. U., Geertzen, J. H. B., & Groothoff, J. W. (2004). Test–retest reliability of the Isernhagen Work Systems Functional Capacity Evaluation in healthy adults. *Journal of Occupational Rehabilitation, 14, 295-305.*

Renemen, M. F., Geertzen, J. H. B., Groothoff, J.W., & Brouwer, S. (2008). General and specific self-efficacy reports of patients with chronic low back pain: Are they related to performances in a functional capacity evaluation? *Journal of Occupational Rehabilitation, 18*, 183-189.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs: General and Applied, 80, 1-28.

Rotter, J. B. (1982). *The Development and Applications of Social Learning Theory: Selected Papers.* New York, NY: Praeger Publishers.

Rotter, J. B., & Hochreich, D. J. (1975). *Personality.* Glenview, IL: Scott, Foresman and Company.

Rybarczyk, B., DeMarco, G., DeLaCruz, M., Lapidos, S., & Fortner, B. (2001). A classroom mind/body wellness intervention for older adults with chronic illness: Comparing immediate and 1-year benefits. *Behavioral Medicine, 27*, 15-27.

Scascighini, L., Toma, V., Dober-Spielmann, S., & Sprott, H. (2008). Multidisciplinary treatment for chronic pain: A systemic review of interventions and outcomes. *Rheumatology, 2008*, 670-678.

Shirado, O., Ito, T., Kikumoto, T., Takeda, N., Minami, A., & Strax, T. E. (2005). A novel back school using a multidisciplinary team approach featuring quantitative functional evaluation and therapeutic exercises for patients with chronic low back pain: The Japanese experience in the general setting. *Spine, 30*, 1219-1225.

Spinhoven, P., ter Kuile, M., Kole-Snijders, A. M. J., Mansfeld, M. H., den Ouden, D., &

Vlaeyen, J. W. S. (2004). Catastrophizing and internal pain control as mediators of outcome in the multidisciplinary treatment of chronic low back pain. *European Journal of Pain, 8*, 211-219.

Turner-Stokes, L., Erkeller-Yuksel, F., Miles, A., Pincus, T., Shipley, M., & Pearce, S. (2003). Outpatient cognitive behavioral pain management programs: A randomized comparison of a group-based multidisciplinary versus an individual therapy model. *Archives of Physical Medicine and Rehabilitation, 84*, 781-788.

Turk, D. C., & Okifuji, A. (2002). Psychological factors in chronic pain: Evolution and revolution. *Journal of Consulting and Clinical Psychology, 70,* 678-690.

Vollenbroek-Hutten, M. M. R., Hermens, H. J., Wever, D., Gorter, M., Rinket, J., & IJzerman, M. J. (2004). Differences in outcome of a multidisciplinary treatment between subgroups of chronic low back pain patients defined using two multiaxial assessment instruments: the Multidimensional Pain Inventory and lumbar dynamometry. *Clinical Rehabilitation, 18,* 566-579.

Wallston, K. A. (1991). The importance of placing measures of health locus of control beliefs in a theoretical context. *Health Education Research, Theory & Practice, 6*, 215-252.

Wallston, K. A. (2005). The validity of the multidimensional health locus of control scales. *Journal of Health Psychology,* 10, 623-631.

Wallston, K. A., Stein, M. J., & Smith, C. A. (1994). Form C of the MHLC Scales: A condition-specific measure of locus of control. *Journal of Personality Assessment, 63*, 534-553.

Wallston, K. A. & Wallston, B. S. (1982). Who is responsible for your health: The construct of health locus of control. In G. Sanders & J Suls (Eds.) *Social Psychology of Health and Illness* (pp. 65-95). Hillsdale, N.J.: Lawrence Erlbaum & Associates.

Wallston, K. A., Wallston, B. S. & DeVellis, R. (1978). Development of the multidimensional health locus of control (MHLC) scales. Health Education Monographs, 6, 160-170.

Ware, J. E., Kosinski, M., & Dewey, J. E., (2000). How to Score Version 2 of the SF-36® Health Survey. Lincoln, RI: QualityMetric Incorporated.

Ware J. E., Kosinski, M. & Keller S.D. (1994). *SF-36 Physical and Mental Healthy Summary Scales: A User's Manual.* Boston, MA: The Health Institute.

Warren, M. L., Houston, S., & Luquire, R. (1998). Collaborative practice teams: From multidisciplinary to interdisciplinary. *Outcomes Management for Nursing Practice, 2*, 95-98.

Wrightson, K. J., & Wardle, J. (1997). Cultural variation in health locus of control. *Ethnicity and Health, 2*, 13-25.