Predicting Stages of Change for Physical Activity in Individuals with Chronic Musculoskeletal Pain: An Integrative and Extended Self-Determination Theory Perspective

by

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DEDICATION

This dissertation is dedicated to those I have loved and lost during the course of my PhD program: My compassionate father and my sweet, charismatic brother. Thank you for making me a better person.

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ABSTRACT

The purpose of this study was to examine the predictive ability of an integrative and extended self-determination theory (SDT) framework as a physical activity and exercise model for individuals with chronic musculoskeletal pain. Two hundred and eleven participants were recruited from clinic and community networks within the United States. Participants completed an online survey including a demographic questionnaire and brief instruments operationalizing the constructs of an integrative and extended SDT model. Data were analyzed using correlational analysis and multiple regression analysis. The findings of this study support the use of an integrative and extended SDT model in predicting physical activity and exercise behavior for individuals with chronic musculoskeletal pain. The model accounts for 56% of the variance in physical activity and exercise stages of change scores. Of the predictor variables, the most significant variables included self-efficacy, control beliefs, and behavioral intentions. A mediation analysis revealed physical activity and exercise partially mediated the relationship between functional disability and physical health related-quality of life. In addition, physical activity and exercise was found to partially mediate the relationship between functional disability and work participation. The results of this study provide empirical evidence supporting the predictive validity of an integrative and extended SDT model for physical activity and exercise participation for individuals with chronic musculoskeletal pain.

CHAPTER ONE

Introduction

Every year, the United States spends trillions of dollars in healthcare costs, which is the highest total spending among industrialized countries (Organization for Economic Co-operation and Development [OECD], 2011). In 2010, the total health expenditures reached $2.6 trillion, and by the year 2021, costs are projected to increase by nearly twofold to $4.8 trillion dollars (Centers for Medicare and Medicaid Services [CMMS], 2012). According to the U.S. Census Bureau, about 56.7 million of the 303.9 million people in the civilian non-institutionalized population have some type of disability impacting their health (Brault, 2012). Even though individuals with disabilities represent roughly 20% of the U.S. population, studies indicate they account for close to 46% of the national healthcare expenditures (Max, Rice, & Trupin, 1996). Fortunately, there is research evidence that suggests the high healthcare costs can be significantly contained through widespread efforts aimed at promoting the overall health and quality of life of people with chronic illness and disability (Ravesloot, Seekins, & White, 2005).

Individuals with disabilities are prone to secondary health problems or chronic diseases, which likely contributes to their diminished health as well as disproportionate rates of early mortality (Pitetti & Campbell, 1991; Simeonsson & Leskinen, 1999). Disability status increases risks for a number of secondary health conditions, such as chronic pain (Kinne, Patrick, & Doyle, 2004), depression (Nosek, Howland, & Hughes, 2001), oral disease (National Institute of Dental and Craniofacial Research [NIDCR], 2002), obesity (Weil et al., 2002), diabetes (McDermott & Platt, 2004), and cardiovascular disease (Scelza, Kalpakjian, Zemper, & Tate, 2005). However, most secondary health conditions can be prevented by establishing lifelong healthy habits (Simeonsson & Leskinen, 1999). In particular, regular physical activity and

exercise can reduce the risks for coronary heart disease, improve overall health status, and enhance life expectancy (American Heart Association [AHA], 2012; Scelza et al., 2005; Wolfe et al., 2012). For example, regular exercise participation can help to improve blood circulation, maintain healthy weight, increase muscle strength, and initiate other healthful practices (Centers for Disease Control and Prevention [CDC], 1996). In spite of the known benefits of physical activity and exercise, health conditions for individuals with chronic illness and disability are often compromised by a sedentary lifestyle (Chan, Chiu, Bezyak, & Keegan, 2012; Leventhal, Rabin, Leventhal, & Burns, 2001).

There are also ubiquitous contextual factors that can support or thwart the health and wellness of people living with disabilities (Drum, Krahn, Peterson, Horner-Johnson, & Newton, 2009; Lee & Paxman, 1997). The largest U.S. public health dataset, DATA2010, reported that the overall health of individuals with chronic illness and disability is likely to be affected by problems with sustaining interpersonal relationships, managing psychological stress, and finding and maintaining community employment (CDC, 2010). Therefore, there is a critical need to enhance the quality of national healthcare delivery, prevention, and health promotion efforts. Experts advocate for change within the current health system, and the Institute of Medicine (IOM, 2010) acknowledged that, in order to produce significant improvements in the health status of all Americans, the system should be modified to operate according to the standards of a holistic, population-based approach to healthcare management (Majette, 2011).

Since 1990, the U.S. Department of Health and Human Services (USDHHS) has appointed workgroups, involving both individuals and organizations within and outside of the Federal government, charged with the task of improving public health. The primary goals of these workgroups were to develop ten-year comprehensive plans, referred to as the *Healthy*

People document with detailed objectives intended to promote health and prevent chronic diseases for the general public. The most recent set of objectives was delineated for *Healthy People 2020* (USDHHS, 2010). *Healthy People 2020* utilized the International Classification of Functioning, Disability, and Health (ICF) and the World Health Organization (WHO) principles of action in order to address the contextual factors that can influence the functioning, health status, and quality of life of individuals with chronic illness and disability in the United States (USDHHS, 2010). *Healthy People 2020* developed specific objectives to improve the health condition of people with chronic illness and disability that include systems and policies, barriers to health care, environment, and activities and participation (USDHHS, 2010). The major target areas aim to improve the health of individuals with disabilities by increasing public resources, addressing the conditions of daily life, and promoting the knowledge of health determinants.

Health Promotion Needs for Individuals with Chronic Musculoskeletal Pain

Over 116 million people live with chronic or recurrent pain in the United States (IOM, 2011). There are many causes for chronic pain, including disabilities such as multiple sclerosis, or chronic musculoskeletal conditions like fibromyalgia. Chronic musculoskeletal pain conditions, especially arthritis and lower back pain, are among the most frequent health complaints in the general population and one of the leading reasons for seeking health care (May, 2010). In 2009, the International Association for the Study of Pain (IASP) sponsored the campaign, "The Global Year Against Musculoskeletal Pain," to draw attention to the millions of individuals suffering from musculoskeletal pain and to establish it as a critical international health priority.

Ineffective pain management practices can lead to reduced employment productivity and overall health status, which consequently can impact both families and society. A total estimate

of $635 billion is spent annually on health care and lost work productivity for individuals with chronic pain in the United States (IOM, 2011). For example, in 2002, the total cost of productivity time lost due to musculoskeletal pain disorders was estimated to be $41.7 billion (Stewart, Ricci, Chee, Morganstein, & Lipton, 2003). In addition, it is common for individuals with chronic musculoskeletal pain to routinely seek healthcare assistance for both pain and secondary health conditions. Systematic reviews and meta-analyses demonstrate that individuals with chronic pain tend to have high rates of the following secondary health conditions: obesity (Shiri, Karppinen, Leino-Arjas, Solovieva, & Viikari-Juntura, 2009), hypertension (Bruehl, Chung, Jirjis, & Biridepalli, 2005), fatigue (Menefee et al., 2000), depression (Blair, Robinson, Katon, & Kroenke, 2003), anxiety (Turk & Monarch, 2002), and sleep disorders (Menefee et al., 2000).

Currently, there is no gold standard treatment available for individuals with chronic musculoskeletal pain in health care. Existing chronic pain treatments include pharmacological, non-pharmacological treatments, or a combination of the two treatments. Research evidence supports the modest effectiveness of pain management approaches, such as: pain medications (American Society of Anesthesiologists Task Force on Chronic Pain Management [ASATFCPM], 2010; Turk, Loeser, & Monarch, 2002); alternative and complementary medicine (Chou & Huffman, 2007; Elkins, Jensen, & Patterson, 2007; Sawitzke et al., 2010); interdisciplinary pain rehabilitation programs (Chen, 2006; Guzman et al., 2001); surgical treatment (Bernstein, 2001; Taylor, Van Buyten, & Buchser, 2005); and structured exercise interventions (Anderson et al., 2008; Chou & Huffman, 2007; Hayden, Van Tulder, Malmivaara, & Koes, 2005). However, it is rare that pain treatment methods completely eliminate chronic pain, and there are issues with long-term use of pain medication (Turk & McCarberg, 2005). For

example, the permanent use of medications can increase risks for tolerance, tolerability, drug diversion, and adverse reactions including neurotoxicity (Turk & McCarberg, 2005). In contrast, the effectiveness of the non-pharmacological treatment approaches is not well understood due to compliance issues (IASP, 2009). Turk and McCarberg (2005) suggest that long-term benefits of non-pharmacological approaches are difficult to maintain due to the complexity of treatment recommendations and promote clinicians to provide follow-up or ongoing support to pain clients to improve treatment adherence.

The IASP (2009) has recommended that lower-intensity physical activity and exercise may be a useful non-pharmacological approach to coping with the effects of long-lasting musculoskeletal pain. In order to improve treatment adherence as well as to reduce long-term costs, it has been suggested that pain intervention programs combine exercise with motivational strategies and cognitive-behavioral techniques (Gatchel & Okifuji, 2006; IASP, 2009; Kratz, Molton, Jensen, Ehde, & Nielson, 2011). Contemporary pain research experts strongly encourage healthcare providers to treat chronic pain conditions using a biopsychosocial framework instead of a medical model to examine the influence and interaction between biological, psychological, and social factors on pain self-management (Williams et al., 2007). Accordingly, pain interventions should address physical symptoms as well as various personal (e.g., motivation, maladaptive coping) and environmental (e.g., social support) contextual factors experienced by individuals with chronic pain. Empirical studies have found that these contextual factors can have a substantial impact on pain symptoms, physical functioning, and mental health status (e.g., Turk & Monarch, 2002).

Preliminary research studies confirm the efficacy of biopsychosocial models in predicting motivation and engagement in pain coping (Kratz et al., 2011; Molton, Jensen, Nielson, &

Cardenas, 2008). For instance, a recent study tested and evaluated the usefulness of a motivational model for pain self-management in people with multiple sclerosis-related pain. The results supported the predictive ability of the model's motivational constructs in explaining the pain coping strategies of task persistence and physical activity participation (Molton et al., 2008). Thus, there appears to be potential utility for applying a biopsychosocial model to the physical activity of individuals with chronic pain, which may have practical implications for pain intervention programs.

Theoretical Framework

It is well established that individuals with and without disabilities can prevent secondary health conditions and improve their overall health-related quality of life through self-regulation of health behavior (e.g., Krahn, Hammond, & Turner, 2006; Schwarzer, Lippke, & Luszczynska, 2011). Health self-regulation refers to the process of discontinuing unhealthy behaviors in favor of adopting health-promoting behaviors (Leventhal et al., 2001). During the past several decades in the field of psychology, numerous social-cognitive theories have been developed in attempts to better understand health behavior self-regulation (Schwarzer, 2008). For example, the classic social-cognitive health theory (SCHT) was developed by Bandura (1986, 1995) in order to investigate the determinants of health behavior. Research studies have provided ample evidence to support the key SCHT predictor variables of self-efficacy and outcome expectancies (e.g., Bandura, 1995; Conner, 2008). Empirical evidence also demonstrates the usefulness of the theory of planned behavior (TPB; Ajzen, 1988, 1991), which posits that the intention to complete a health behavior is determined by an individual's attitudes, subjective norms, and perceived behavioral control. Another established theory is the transtheoretical model (TTM; DiClemente & Prochaska, 1982) that is a comprehensive, stage-based perspective on readiness to change

health behaviors. Finally, a relatively new health promotion model that is receiving attention in the literature is the health action process approach (HAPA; Schwarzer, 1992), which is an integrated theory that posits the adoption and maintenance of health behaviors can be explained as a process composed of a motivational phase and a volitional phase (Conner, 2008; Schwarzer et al., 2011).

These long-standing health promotion theories have assessed, validated, and underscored the predictive value of social-cognitive variables in explaining behavior from a biopsychosocial perspective (Deci & Ryan, 2002). However, these traditional social-cognitive theories only partly explain the possible motivational determinants of health behaviors, and none have yet to incorporate the psychological construct of motivation regulation in an integrative health promotion model. Researchers assert that humans are active organisms that must satisfy the innate nutriment of autonomy prior to initiating and maintaining health behaviors, and experimental studies have revealed that autonomy enables intrinsic motivation, whereas extrinsic rewards weaken any inherent interest in healthy activity (e.g., Deci & Ryan, 1985, 2000; Koestner & Losier, 2002). These initial studies inspired researchers like Deci and Ryan to establish a motivational model for behavior change based on the organismic metatheory of self-determination.

Over the past 20 years, the theory of self-determination has been frequently applied in motivational research (Ryan, Patrick, Deci, & Williams, 2008). Influenced by humanistic approaches (e.g., Rogers, 1961), the underlying assumptions of self-determination theory (SDT; Deci & Ryan, 1985) promote that individuals have a natural tendency toward a unified sense of self (Deci & Ryan, 2002). The SDT researchers advocate that self-growth can only occur when an individual is able to sustain and preserve the three basic psychological needs for autonomy,

competence, and relatedness. Autonomy refers to an individual's ability to feel a sense of volition with respect to choices and behaviors (Williams, 2002). Autonomy concerns acting from an internalized or intrinsic motivation orientation. Competence is defined as the degree to which one believes that he or she is able to successfully achieve goals and outcomes, similar to Bandura's conceptualization of self-efficacy and outcome expectancies. Lastly, relatedness is described as the need to feel connected to and supported by others. Ryan and Deci (2000) postulate that individuals must fulfill these basic self-determination needs to develop internal motivation. By tapping into individual's innate propensity for self-actualization, health professionals can better facilitate behavior change (Williams, 2002).

Health promotion research has provided empirical evidence for the applicability of the central aspects of the SDT model. For instance, this model has been tested on individuals in longitudinal studies on smoking cessation (Williams, Gagne, Ryan, & Deci, 2002), alcohol treatment (Ryan, Plant, & O'Malley, 1995), medication adherence (Williams, Rodin, Ryan, Grolnick, & Deci, 1998), and weight loss (Williams, Grow, Freedman, Ryan, & Deci, 1996). The results have consistently demonstrated that feelings of relatedness, autonomy, and competence significantly predict whether individuals initiate and maintain health behavior change. Recently, the SDT model has also shown to accurately predict exercise and physical activity participation (e.g., Edmunds, Ntoumanis, & Duda, 2006; Moreno, Cervello, & Martinez, 2007; Rouse, Ntoumanis, Duda, Jolly, & Williams, 2011; Silva et al., 2008). However, there is a dearth of health behavior studies integrating SDT with other social-cognitive theories, especially for individuals with chronic illness and disability (e.g., McBride et al., 2010; Russell & Bray, 2010; Williams, McGregor, Zeldman, Freedman, & Deci, 2004). In light of the paucity of research investigating the relationship between SDT constructs and health-promoting behaviors of

individuals with chronic illness and disability, there is a critical need for additional empirical studies.

Purposes of Study

Past studies have demonstrated that individuals with disabilities can prevent secondary health conditions and improve their overall health-related quality of life through health self-regulation (e.g., Schwarzer et al., 2011). Nonetheless, the previous health behavior theories have not completely explained the regulatory processes involved in the motivation for health change. Deci and Ryan (1985, 2002) have developed and advanced a motivational model for behavior change based on self-determination theory. The SDT model has been applied, tested, and validated in predicting the initiation and maintenance of various health behaviors (e.g., Williams et al., 1996).

Accumulated research evidence demonstrates the predictive value of the SDT model in explaining the motivational processes involved in health behavior. However, authors argue that the SDT constructs fail to elucidate how individuals transition from a motivational to action state (e.g., Haggar, Chatzisarantis, Culverhouse, & Biddle, 2003). Researchers suggest that social-cognitive theories may have the potential to complement the SDT explanation for physical activity engagement. The present study is proposing an SDT model that would incorporate components of previously tested and validated social-cognitive theories on health promotion including the following: social-cognitive health theory (SCHT; Bandura, 2004), theory of planned behavior (TPB; Fishbein & Ajzen, 1975), transtheoretical model (TTM; Prochaska & DiClemente, 1983), and health action process approach (HAPA; Schwarzer, 1992; Schwarzer et al., 2011). A recent meta-analysis reviewed previous studies that integrated SDT with TPB constructs and reported that the integrated health promotion model explained approximately 58%

of the variance in physical activity in adults without disabilities (Hagger & Chatzisarantis, 2009). Therefore, the grouping of organismic and social-cognitive variables appears to have a large effect on health behaviors, which may suggest that integrated theory of SDT may help to enhance the predictive value of health promotion models (Hagger et al., 2011). It is also proposed that evaluating contextual factors (i.e., pain catastrophizing, resilience, pain acceptance, mindfulness, and exercise social support) relevant to people with chronic pain may further extend the explained variance in physical activity participation. As a result, the primary purpose of this study is to apply an integrative and extended model of self-determination theory to individuals with chronic pain disabilities in order to better understand and predict physical activity behavior.

Individuals with chronic pain experience difficulties with initiating and maintaining physical activity and exercise, despite the fact that it can reduce pain, prevent secondary health conditions, and improve health-related quality of life. Accordingly, there is a substantial need to advance health-promoting strategies for individuals with chronic pain in order to increase participation in regular physical activity. Preliminary evidence has shown the usefulness of motivational models in predicting healthy coping behaviors among people with chronic pain (Kratz, Molton, Jensen, Ehde, & Neilson, 2011; Molton et al., 2008). Furthermore, initial research studies have provided validity for the effectiveness of an integrated model of the SDT in promoting health behaviors (e.g., Williams et al., 1996), but it has yet to be applied to the health-promoting activities of individuals with disabilities, such as chronic musculoskeletal pain. Thus, there may be potential for a self-determined approach in enhancing treatment adherence for individuals with chronic musculoskeletal pain. It is proposed that the health regulatory features of an integrative and extended self-determination model seem to match the treatment needs of

individuals with chronic pain. This study will investigate the proposed model in an attempt to better explain and predict the pain self-management strategy of physical activity behavior. With better motivation and self-management strategies, individuals with chronic pain may learn to cope with pain, which in turn, can help them to adapt to their pain condition. After pain coping and disability adjustment, individuals may be more apt to participate in the community – paving the way to an improved health-related quality of life.

Research Questions and Hypotheses

Three primary research questions are:

1. To what extent are the integrative and extended SDT constructs (i.e., disability-related characteristics; contextual factors; autonomy, competence, and relatedness; attitudes, subjective norms, perceived behavioral control, action/coping planning; and intentions) predictive of physical activity participation for individuals with chronic musculoskeletal pain? It is hypothesized that each set of SDT predictors will significantly impact the effect size of the overall regression model.
2. Does physical activity participation mediate the relationship between functional disability and physical health-related quality of life? For this research question, it is hypothesized that physical activity participation will partially mediate the relationship between functional disability and physical health-related quality of life.
3. Does physical activity participation mediate the relationship between functional disability and work participation? For this research question, it is hypothesized that physical activity participation will partially mediate the relationship between functional disability and work participation.

CHAPTER TWO

Literature Review

Since ancient times, scholars have been writing prescriptions for optimal health and wellness. In 380 BCE, the Greek philosopher Plato wrote, "The part can never be well unless the whole is well" (Institute of Medicine [IOM], 2011). This wise adage remains true in the modern era. An individual's health cannot be whole or complete unless all of its parts are intact. Health promotion efforts must conceptualize health in holistic terms in order to enhance quality of care. In 1948, the World Health Organization (WHO) defined health as, "The state of complete physical, emotional, and social well-being, not merely the absence of disease or infirmity" (WHO, 2005). Decades later, health organizations are expanding upon this definition and promoting its usefulness in order to reinforce the need to address elements of biological, psychological, and social health (Drum, Krahn, Peterson, Horner-Johnson, & Newton, 2009).

There are numerous health behavior theories that describe health from a biopsychosocial perspective. The primary purpose of this study is to test and evaluate a holistic health promotion model based on an integrative and extended version of self-determination theory (SDT; Deci & Ryan, 1985). The integrative and extended SDT model will be applied to individuals with chronic musculoskeletal pain in order to better understand and predict physical activity and exercise behavior. Individuals with chronic pain experience significant difficulties with initiating and maintaining healthy pain coping strategies, such as physical activity. Accordingly, there is a critical need to advance health-promoting strategies for individuals with chronic pain in order to improve treatment retention rates and outcomes. This literature review will include sections on the following areas: health promotion for people with disabilities, physical activity and exercise, individuals with chronic musculoskeletal pain, health behavior theories, and contextual factors in

health promotion.

Health Promotion for People with Disabilities

The WHO International Classification of Functioning, Disability, and Health (ICF) model affords the opportunity for individuals with disabilities to be included in research, policies, and programs on health promotion (WHO, 2001). This multi-dimensional and universal framework for health conditions describes a full range of human functioning (Peterson, 2005). Functional ability can be impacted by an individual's body structure or function; activities and participation; and contextual factors. Because a holistic definition emphasizes various mechanisms of health, it reveals that disability and health can coexist (Drum, Peterson, & Krahn, 2008). Individuals with disabilities may have functional limitations in certain health areas, but they can learn to compensate, cope, and adjust to life difficulties. Hence, disability should not be confused with disease or illness. Individuals with disabilities can adapt to and thrive in their lives in order to enhance their health and wellness.

A qualitative study by Putnam and colleagues (2003) examined the meaning of health and wellness for a group of individuals with long-term disabilities. There were a total of 99 participants in the study with disabilities such as cerebral palsy, multiple sclerosis, and spinal cord injury. The study findings indicated that the participants arrived at a consensus for a multi-dimensional definition of health. The shared conceptualization included four components: (1) being able to function and participate in activities; (2) having self-determination about choices and opportunities; (3) having physical and subjective well-being; and (4) not being controlled by pain. These defining parts include a focus on physical, mental, and social aspects of health (Drum et al., 2009). Another qualitative study investigated the experience of health and wellness for eight participants living with various chronic conditions (Lindsey, 1996). The common health

themes reported were: (a) honoring the self, (b) seeking and connecting with others, (c) creating opportunities, (d) celebrating life, (e) transcending the self, and (f) acquiring a state of grace. The findings reveal that social support, spirituality, and quality of life may be noteworthy features of health and wellness. The results from qualitative studies endorse that individuals with disabilities also recognize the importance of biopsychosocial health. A reconceptualization of health and wellness represents ideals that individuals with disabilities can learn to strive for, achieve, and integrate in their daily lives.

Although individuals with disabilities are capable of improving their health-related quality life, this is not a straightforward endeavor. There are countless health disparities, including inequitable policies, barriers to healthcare resources, environmental obstacles, and limitations to activities and participation (U.S. Department of Health and Human Services [USDHHS], 2010). The health disparities of individuals with disabilities have not gone unnoticed by government authorities. Since the 1990s, the USDHHS has appointed workgroups charged with the task of improving public health. The main goals of workgroups were to develop ten-year comprehensive plans, referred to as *Healthy People*, with detailed objectives intended to promote health and prevent diseases for the general public. Under the section, "Disability and Health," *Healthy People 2020* has highlighted the following major target areas: increase public resources, address the conditions of daily life, and promote the knowledge of health determinants.

Broadly speaking, health determinants can include contextual factors that are biological, psychological, and social in nature. Biological or psychological factors can influence an individual's health due to the fact that people with disabilities are more susceptible to secondary health problems, chronic diseases, and early mortality (Simeonsson & Leskinen, 1999). People

with disabilities are at an increased risk for experiencing secondary conditions that may complicate their heath including chronic pain, osteoporosis, sleep disorders, and gastro-intestinal problems (Kinne, Patrick, & Doyle, 2004; Rimmer et al., 2010). Furthermore, individuals with disabilities are more likely to be diagnosed with chronic diseases that may include obesity (Weil et al., 2002), diabetes (McDermott & Platt, 2004), and cardiovascular disease (Scelza, Kalpakjian, Zemper, & Tate, 2005). Secondary conditions and chronic diseases are often considered to be preventable (Simeonsson & Leskinen, 1999). However, social factors can also provide roadblocks to health promotion efforts. Individuals with disabilities are disproportionately involved in education, employment, and community activities. For example, the 2004 NOD/Harris survey reported that 21% of individuals with disabilities drop out of high school in the United States, compared to the only 11% of individuals without disabilities (Krane & Hanson, 2004). In 2010, The U.S. Census Bureau reported that only 41.1 percent of working age adults with disabilities were employed in comparison to the 79.1 percent of people without disabilities (Brault, 2012). In addition, the largest public health dataset, DATA2010, reported that individuals with disabilities are more likely to experience problems with receiving social support and managing psychological stress (Centers for Disease Control and Prevention [CDC], 2010). Therefore, social determinants of health may act as mediators for the relationship between disability limitations and health outcomes (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003). Accordingly, contextual factors can have a significant influence on health regardless of disability impact.

Recently, there has been an emergence of health promotion programs designed to help individuals with disabilities to develop strategies for fostering and maintaining positive health and wellness. For example, a study by Ravesloot, Seekins, and White (2005) investigated the

effectiveness of health promotion strategies for individuals with physical disabilities. A total of 188 participants were recruited from 9 independent living centers in the United States. The researchers facilitated a *Living Well with a Disability* health promotion intervention for 8 weeks. The *Living Well with a Disability* program was initially designed and piloted by Ravesloot and colleagues (1998) in an effort to prevent and reduce the severity of secondary health conditions for people with disabilities. The results from pilot indicated that participants reported that they did not feel limited by their secondary conditions, and the findings from the 2005 study by Ravesloot et al. appeared to show consistent results. The study findings in 2005 demonstrated reductions in limitations from secondary conditions, symptom days, and health care utilization over the intervention period. Consequently, there was a total cost savings of $807 per study participant due to reductions in health care utilization during the study time frame. The reported effects on secondary conditions were maintained for 12 months.

Additional intervention studies have also demonstrated that a change in health behaviors can impact health-related quality of life. A study by Stuifbergen and Roberts (1997) revealed that health-promoting behaviors in women with multiple sclerosis mediated the relationship between disability severity and health-related quality of life. Despite the potential effectiveness of health promotion strategies, the health conditions for individuals with disabilities are often demoted by unhealthy behaviors, such as overeating or lack of physical activity (Leventhal, Rabin, Leventhal, & Burns, 2001).

Physical Activity and Exercise

It is now well documented that sedentary lifestyles are associated with higher rates of mortality and morbidity (Craig, Russell, Cameron, & Beaulieu, 1999), and represent one of the most prevalent behavioral health risks in industrialized countries (US Department of Health &

Human Services, 1996). Abundant research studies demonstrate that regular physical activity can have life-altering consequences for individuals with and without disabilities. The American Heart Association (2012) indicates that physical activity can increase life expectancy and reduce the risks for coronary heart disease. More specifically, regular physical activity can improve blood circulation, keep weight under control, and establish other lifestyle habits. The Surgeon General's *Report on Physical Activity and Health* recommends that every adult should engage in moderate-intensity physical activity at least 30 minutes daily (Centers for Disease Control and Prevention [CDC], 1996). In addition, the CDC also indicated that empirical studies have established that regular physical activity for people with disabilities can improve muscle strength, physical stamina, and health-related quality of life by increasing the ability to perform activities of daily life (Scelza, Kalpakjian, Zemper, & Tate, 2005; Wolfe et al., 2012).

This study will primarily focus on the health outcome of physical activity and exercise behavior. Physical activity and exercise self-report instruments often ask an individual to recall their level of participation in aerobic activity. Different self-report tools have been designed to measure energy expenditure by asking questions about exact duration and amount of physical activity, while other instruments require reports of only rough estimates of activity levels (Mannerkorpi & Hernelid, 2005). There is not a consensus in the field of rehabilitation about what type of instrument should be utilized with individuals with disabilities. However, many of the instruments that assess an individual's aerobic activity were originally designed for healthy adults and may have limited applicability to individuals with disabilities.

There are several reasons why the operationalization of aerobic exercise does not adequately take into consideration the needs of people with disabilities. First, the capability for intense physical activity and exercise are typically lower for individuals with disabilities since

functional problems can prevent individuals from engaging in certain levels or amounts of physical activity (Washburn et al., 2002). Therefore, individuals may be required to pace their activities, take frequent breaks, and reduce total amount of physical activity. In addition, individuals with disabilities experience difficulties with regularly engaging in any type of physical activity due to a number of contextual barriers. Perceived barriers to physical activity and exercise may be understood as a function of internal or external impediments. Perceived health barriers often include external obstacles, such as public attitudes, policies, procedures, inaccessible facilities or insufficient resources; and internal obstacles including lack of motivation, health concerns, and psychological barriers which are subjectively experienced as hurdles, such as fear of unfamiliar surroundings and situations (Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004).

Consequently, researchers recommend that a more appropriate self-report instrument for people with disabilities may focus on reduced intensity levels of leisure physical activity and exercise (Mannerkorpi & Hernelid, 2005). This lower intensity of physical activity and exercise takes into account that individuals may need to accommodate their disability limitations by reducing level of activity. And leisure physical activity may be a more realistic option for individuals with disabilities, as it likely reduces perceived exercise barriers since the activities are integrated within an individual's current life situation. For instance, by engaging in leisure physical activity, individuals with disabilities may not be required to find an accessible or convenient gym if they participate in recreational activities, such as walking in a nearby park. Nigg et al. (2005) operationalized leisure-time physical activity and exercise to include various tasks related to walking, biking, or other moderate-intensity, leisure physical activities. This scale may be more appropriate for people with disabilities due to its de-emphasis on high-

intensity types of aerobic activity. This study will utilize the aforementioned scale in an attempt to better describe, understand, and predict participation in physical activity and exercise for people with chronic musculoskeletal pain.

Individuals with Chronic Musculoskeletal Pain

In industrialized countries, chronic pain afflicts as many as one-third of the citizens (Du et al., 2010). This estimate is consistent with a 2011 IOM report that indicated approximately 116 million Americans experience chronic pain conditions, which has resulted in annual economic costs over $630 billion dollars. This widespread chronic pain condition can impact any person for the reason that etiology is influenced by numerous risk factors, such as: genetic predisposition (e.g., migraine), unknown cause (e.g., fibromyalgia), disability (e.g., multiple sclerosis), chronic disease (e.g., cancer), age (e.g., arthritis), post-surgical outcome (e.g., severed nerves), or injury (e.g., back pain) (IOM, 2011). One of the most common types of pain conditions is musculoskeletal pain. For example, a study by Deyo, Mirza, and Martin (2006) reviewed data from the National Health Interview Survey (NHIS) in 2002 and found that 26.4% of Americans reported low back pain for at least an entire day during a period of 3 months. However, in order for pain to be diagnosed as chronic instead of acute, it must persist for 3 to 6 months or longer than the expected healing time (IOM, 2011). Clinical symptoms of chronic musculoskeletal pain include persistent, local or widespread symptoms of pain, tenderness, peripheral nerve irritation, weakness, and limited motion and stiffness (International Association for the Study of Pain [IASP], 2009).

Chronic pain symptoms can be further aggravated by work-related stress, psychosocial problems, or poor health status. Hence, individuals with chronic pain may have work attendance issues. For example, 7.2% of employed workers in the United States report losing on average 5

to 5.5 hours of work on a weekly basis due to back pain, arthritis, or other musculoskeletal pain conditions (Stewart, Ricci, Chee, Morganstein, & Lipton, 2003). Additionally, individuals with chronic pain have higher rates of psychological disorders, such as depression or anxiety (Turk & Monarch, 2002). Psychological symptoms are often linked to fear or worry about avoiding re-injury, which can influence individuals to evade physical activity at work or in the community (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). Chronic pain is also commonly associated with several other health conditions that can lead to supplementary treatment needs, work productivity challenges, and consequently, further economic burden. Meta-analyses and systematic reviews demonstrate that individuals with chronic pain tend to have higher rates of obesity (e.g., Shiri, Karppinen, Leino-Arjas, Solovieva, & Viikari-Juntura, 2009), hypertension (Bruehl, Chung, Jirjis, & Biridepalli, 2005), fatigue (e.g., Menefee et al., 2000), and sleep disorders (e.g., Menefee et al., 2000). Chronic pain conditions not only impact the individuals experiencing pain directly, but it also has a negative affect on their significant others. For example, the spouses of chronic pain clients have reported higher levels of distress than the spouses of clients with other chronic medical conditions (e.g., Flor, Turk, & Scholz, 1987). Not surprisingly, individuals affected by chronic pain often cite reduced health-related quality of life (Gatchel & Okifuji, 2006). Therefore, living with chronic pain can lead to ongoing difficulties with managing life aspects related to overall health and wellness (Turk & Monarch, 2002).

Available treatments for individuals with chronic pain conditions include either pharmacological treatments, non-pharmacological treatments, or a combination of the two. However, it is rare that treatment approaches completely eliminate pain (Turk & McCarberg, 2005). Therefore, individuals must learn to cope with the experience of long-lasting, chronic pain. For coping with chronic pain, lower-intensity exercise has been recommended as beneficial

in reducing pain for individuals with chronic musculoskeletal pain (IASP, 2009). Numerous experimental studies have demonstrated the modest effectiveness of structured exercise programs for individuals with chronic pain (Anderson et al., 2008; ASATFCPM, 2010; Ferreira, Smeets, Kamper, Ferreira, & Machado, 2010; Frost et al., 1998; Hurwitz, Carragee, & van der Velde, 2008). For example, a recent meta-analysis of 21 randomized controlled trials found that long-term exercise programs, but not intermediate- or short-term, had a significant effect on work disability in people with chronic back pain (Oesch, Kool, Hagen, & Bachmann, 2010). However, researchers note issues with long-term treatment compliance, and suggest that pain programs combine exercise with motivational or cognitive-behavioral strategies in order to enhance adherence (e.g., Gatchel & Okifuji, 2006). Kerns and Rosenberg (2000) have asserted that the degree to which individuals with chronic pain are willing to adopt a motivational perspective will predict whether they benefit from treatment. Preliminary research supports the effectiveness of motivational models in explaining and predicting the coping strategies for chronic pain (Kratz, Molton, Jensen, Ehde, & Neilson, 2011; Molton, Jensen, Nielson, & Cardenas, 2008). For instance, Molton and colleagues found that individuals with multiple sclerosis-related pain who reported high levels of readiness participated more often in pain coping strategies of task persistence and physical activity. Thus, there appears to be potential utility for a motivational model for pain coping, which may have practical implications for pain intervention programs.

Since pain disability and rehabilitation is based on a complex grouping of various health aspects, present clinical opinion has established that chronic pain should be understood through the lens of a biopsychosocial perspective by examining the influence of and interaction between biological and psychosocial factors (Williams, Hapidou, Lin, & Abbasi, 2007). Biological factors refer to physiological components, while psychosocial factors encompass emotional, cognitive,

and environmental variables. Collectively, these biopsychosocial factors shape the way individuals interpret and cope with chronic pain.

Biological Aspects

The types of chronic musculoskeletal pain conditions are broad and complex, including many categories of pain, such as neck pain, limb pain, low back pain, joint pain, bone pain, chronic widespread pain, and numerous others (IASP, 2009). Regardless of the various types, all of the musculoskeletal pain disorders share common underlying mechanisms and clinical symptoms. However, the intensity of pain differs greatly among pain patients in health care settings (Turk & Monarch, 2002). Individuals with similar pain conditions vary in reported symptom severity and in response to pain treatment. There is also often no evidence for a physical cause, or clinically significant pain is unrelated to a specific disorder. This variation in pain diagnostics may occur due to both physiological and non-physiological factors.

When tissue damage occurs, an individual's neural systems will go through a process of nociception (Melzack, 1999). Nociception involves the stimulation of nerve endings after tissue is damaged; this physical injury event is communicated to the central nervous system. Long-lasting nociceptive input from the muscle is more likely to induce central neuroplastic change than from skin nociceptive input (IASP, 2009). Nociceptive muscle input increases excitability of central neurons leading to musculoskeletal pain, which is processed after sensory information is filtered through an individual's genetic predisposition, current physiological status, emotional responses, cognitive appraisals, and social environment (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). If acute pain is not reduced or eliminated, the muscle nociceptors can become sensitized leading to chronic musculoskeletal pain (Arendt-Nielsen & Graven-Nielsen, 2008).

Psychosocial Aspects

The psychosocial factors for pain involve emotional, cognitive, and environmental variables. Emotion is considered an immediate response to the nociceptive process (Gatchel et al., 2007). Cognitions then attach meaning to the emotional experience and stimulate further emotional reactions, escalating the painful reaction. Environmental variables are also important to the psychosocial process as individuals learn pain responses and pain behavior from stimuli in their social environments (Turk & Monarch, 2002). Consequently, the three psychosocial variables can contribute to the multifaceted cycle of sensory processing, pain response, and functional disability.

Emotional variables. During the perceptual experience of chronic pain, an individual's affective state or mood can interact with and influence the level of pain intensity. In response to the unpleasant occurrence of pain, individuals can feel considerable emotional stress, which can contribute to psychological disturbance and further worsen the symptoms of chronic pain (Turk & Monarch, 2002). There is copious evidence revealing the higher prevalence rates of depression and anxiety for individuals with chronic pain. However, recent research has demonstrated that anger may also play a role in the emotional reaction to pain (Gatchel et al., 2007). Consequently, the affective components of pain can lead to issues with a variety of psychological problems like depression, anxiety, and anger.

Historically, levels of depression have been intimately tied to chronic pain (Gatchel, 2005). Research findings reveal that approximately 40% to 50% of chronic pain patients experience depression, wherein most cases are linked to pain disability (Dersh, Gatchel, Mayer, Polatin, & Temple, 2006; Romano & Turner, 1985). It appears that there may be a symbiotic relationship between depression and chronic pain (Rudy, Kerns, & Turk, 1988). Investigators

postulate that there may be a common trait of vulnerability for both dysphoric physical and negative psychological symptoms (Von Korff & Simon, 1996). This mutually reinforcing relationship between depression and chronic pain may increase disability and ultimately lead to poorer rehabilitation outcomes. Kerns and Haythornthwaite (1988) reported that depression was related to higher drop-out rates in pain rehabilitation programs. Interestingly, studies have found that individuals are less likely to become depressed if they feel that they are able to manage pain and function in spite of it (e.g., Okifuji, Turk, & Sherman, 2000).

In addition, chronic pain patients often experience symptoms of anxiety related to fears and worries about their condition (Gatchel et al., 2007). They may be concerned about whether they will ever be able to relieve their pain, or if the pain will increase and restrict their activity. These fears may also be amplified by thoughts or behaviors connected to harm-avoidance (Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995). Research studies have demonstrated that individuals with anxiety may ruminate over threats of pain or injury, causing more pain and influencing them to avoid harm through physical inactivity (e.g., Crombez, Vervaet, Lysens, Eelen, & Baeyerns, 1998). For example, Crombez, Vlaeyen, Heuts, and Lysens (1999) found that, after controlling for the effects of pain severity, pain-related fear was the strongest predictor of an individual's performance in weight-lifting tasks.

Anger is also frequently observed in chronic pain patients (Turk & Monarch, 2002). Individuals with chronic pain may feel anger or frustration in response to pain and disability (Gatchel et al., 2007). They may feel frustrated when the pain is persistent, the cause is unknown, or it is affecting their day-to-day functioning. They may also acknowledge hostility toward employers, the healthcare system, family members or even themselves. Recent empirical studies demonstrate that anger in individuals with chronic pain may contribute to and lead to

increased pain. For example, studies have reported that symptoms of anger and frustration are linked with higher levels of pain (e.g., Kerns, Rosenberg, & Jacobs, 1994). Internalized feelings of anger related to pain also appear to be significantly associated with depression and with physical activity interference (Okifuji, Turk, & Curran, 1999).

Cognitive variables. Individuals may interpret pain through the process of pain appraisal (Gatchel et al., 2007). Pain appraisal involves evaluating the significance of pain, pain controllability, and available coping resources. Individuals may hold underlying beliefs about the pain experience, which may also have an effect on the appraisal of pain. A plethora of research studies have confirmed that an individual's pain beliefs and appraisal of physical sensations will dramatically impact their experience of pain, as well as functional disability and general response to treatment (e.g., Jensen, Turner, Romano, & Lawler, 1994; Schmidt, 1985; Schwartz, DeGood, & Shutty, 1985). Moreover, pain appraisal and pain beliefs have been found to be strong predictors of adjustment to pain disability (e.g., Turner, Jensen, & Romano, 2000).

Unfortunately, a major portion of individuals with chronic pain endorses the belief that pain cannot be controlled (Turk & Monarch, 2002). Perceived controllability refers to whether an individual maintains the belief that they can achieve some control over the intensity, duration, or frequency of a pain stimulus (Gatchel et al., 2007). In chronic pain patients, the belief of controllability over a pain stimulus may reduce its overall impact (e.g., Spinhoven et al., 2004; Wells, 1994). Contradictorily, other studies have demonstrated that continuous attempts at controlling pain that end in failure may lead to frustration and rumination, which can eventually exacerbate pain and disability (McCracken, Carson, Eccleston, & Keefe, 2004). Researchers suggest that it may be more effective to accept the effects of pain and to gain control over the impact that pain has on daily functioning (Tan et al., 2002). Several empirical studies have found

that the construct of pain acceptance is associated with lower pain and better disability adjustment (McCracken, 1998; McCracken & Eccleston, 2003; McCracken, Spertus, Janeck, Sinclair, & Wetzel, 1999). In light of the mixed findings on perceived controllability, additional research is needed to resolve this issue (Gatchel et al., 2007).

Similar to perceived control is the belief of self-efficacy. Self-efficacy is defined as an individual's expectation that he or she can successfully initiate and complete an activity. The pain literature is replete with studies that indicate that higher perceived self-efficacy is linked to pain reduction, physical functioning, psychological adjustment, and treatment outcomes (e.g., Dohnke, Knauper, & Muller-Fahrnow, 2005; Keefe et al., 2004; Lorig, Chastain, Ung, Shoor, & Holman, 1989; Marks, 2001). Therefore, self-efficacy is likely a valuable motivational determinant for health promoting behaviors in pain management.

It is also common for chronic pain patients to endorse cognitive distortions, such as catastrophizing. Pain catastrophizing can be described as exaggerated maladaptive thoughts or negative expectations regarding outcomes (Turk & Monarch, 2002). Numerous literature reviews have found that catastrophizing predicts overall pain adjustment (e.g., Edwards et al., 2011; Smeets et al., 2006). It also has long been known that catastrophizing is related to the onset of chronic musculoskeletal pain (Edwards et al., 2011), and preliminary studies demonstrate that it also may be predictive of the surgery recovery process (e.g., Granot & Ferber, 2005; Picavet, Vlaeyen, & Schouten, 2002). Another maladaptive cognition - although also related to anxiety – is referred to as fear-avoidance and has been shown to be associated with pain and disability (Gatchel et al., 2007). Fear-avoidance is theorized to have emotional, cognitive, and behavioral components. Prospective studies reveal that fear-avoidance beliefs may be correlated with the future onset of back pain (e.g., Picavet et al., 2002). Due to the overwhelming evidence on the

roles of pain maladaptive beliefs, rehabilitation intervention methods often aim to reduce these cognitions. Traditional cognitive-behavioral strategies can teach individuals to cope with chronic pain by replacing maladaptive beliefs, such as pain catastrophizing, with adaptive cognitions, emotions, and related behaviors (Gatchel et al., 2007). As mentioned, research studies have consistently shown relationships between reductions in thought content with improvements in functioning during treatment (e.g., Jensen, Turner, & Romano, 2007). Yet, it is not clear that techniques geared toward modifying thought content cause the changes in functioning as it appears thoughts can change even when cognitive change methods are not applied (Smeets, Vlaeyen, Kester, & Knottnerus, 2006; Vowles, McCracken, & Eccleston, 2007). Moreover, therapeutic attempts to alter irrational thoughts sometimes, paradoxically, increase pain intensity (Goubert, Crombez, Eccleston, & Devulder, 2004; Masedo & Rosa Esteve, 2007; Sullivan, Rouse, Bishop, & Johnston, 1997).

Modern cognitive-behavioral therapy approaches, like acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999), highlight experiential methods rather than didactic ones, use metaphors instead of direct language, change responses to symptoms over the modification of actual symptoms, and emphasize the qualities more than the techniques of the treatment provider (Hayes, Follette, & Linehan, 2004; Hayes, Villatte, Levin, & Hildebrandt, 2011). Randomized controlled trials of the various types of cognitive-behavioral therapies for chronic pain show that these strategies are more effective in reducing pain and improving health-related quality of life when compared to control groups (Eccleston, Williams, & Morley, 2009). A cognitive strategy that is linked to reduced pain and enhanced functional ability includes adaptive cognitive coping techniques, such as acceptance, mindfulness, or task persistence (e.g., Cusens, Duggan, Thorne, & Burch, 2010; Grossman et al., 2007; Turk & Monarch, 2002). A

recent meta-analysis of 66 experimental studies of acceptance- and mindfulness-related processes concluded that these variables are supportive of positive psychological outcomes (Levin, Hildebrandt, Lillis, & Hayes, 2012). Active coping strategies that are behavior-oriented, such as relaxation, social support, or exercise, are also associated with adaptive functioning for individuals with chronic pain. There is ample evidence-based data available that suggests the different cognitive-behavioral strategies are both cost-effective and efficacious techniques that should be included in interdisciplinary pain management programs (Eccleston, Williams, & Morley, 2009; Gatchel & Okifuji, 2006).

Environmental variables. Individuals may also learn to respond to pain and suffering by observing people within their social environment (Turk & Monarch, 2002). These attitudes may be acquired from family members, friends, health care professionals, or from other social influences. There is substantial evidence from experimental studies on the significant role of social learning on individuals in pain (Gatchel et al., 2007). For example, Vaughan and Lanzetta (1981) reported that individuals learned pain responses to stimuli from observing others in pain. The pain literature also reveals that another environmental pressure on chronic pain occurs through the mechanism of operant conditioning (Turk & Monarch, 2002). The theory of operant conditioning posits that individuals who receive no external reinforcement (or punishment) will decrease or extinguish pain behaviors, while individuals who receive positive reinforcers will adopt pain behaviors. For example, Turk, Kerns, and Rosenberg (1992) demonstrated that pain patients reported more pain severity and less activity when they had spouses who were solicitous. Investigators have noted that the social environment may have an impact on all learned pain beliefs and behaviors of chronic pain patients (Gatchel et al., 2007). Thus, it is

essential for pain models to incorporate environmental variables in order to better explain pain conditions.

Individuals with chronic pain may feel restricted by their physical condition, which may prevent them from participating in physical activities in various life settings, such as home, work, or social environments. As described in this section, each individual with chronic pain may experience a physical condition in a different way based on his or her own biological, psychological, and social variables. The biopsychosocial perspective is now widely accepted as the most useful model in explaining chronic pain and determining treatment (e.g., Gatchel et al., 2007). Furthermore, studies reveal that each biopsychosocial factor may have an impact on physical functioning and general health outcomes. Researchers suggest that pain models should be designed based on biopsychosocial theories in order to improve efficacy and cost-effectiveness of rehabilitation interventions (Gatchel & Okifuji, 2006).

Health Behavior Theories

In order to facilitate successful behavior change, health professionals need to be able to determine an individual's readiness for health behavior regulation and maintenance. Therefore, the ultimate goal of health promotion approaches is to increase the likelihood that individuals will learn to self-regulate health behaviors. Over time, numerous health behavior theories have been established in efforts to evaluate and understand the biopsychosocial factors underlying health behavior processes (Conner, 2008; Schwarzer, 2008).

This section will underscore a relatively new health behavior theory primarily based on the metatheory of self-determination (Deci & Ryan, 1985). In particular, there will be a review of the theoretical components, research evidence, and limitations. Finally, this section will conclude with information on traditional health behavior theories that include the social-cognitive health

theory (SCHT; Bandura, 1977, 1987, 1997), theory of planned behavior (TPB; Ajzen, 1985, 1988, 1991), transtheoretical model (TTM; Prochaska & DiClemente, 1983), and health action process approach (HAPA; Schwarzer, 1992).

Self-Determination Theory

The contextual environment that individuals learn, live, and work in provides social conditions that considerably impress aspects of personal growth (Tripathi & Samantaray, 2011). In particular, distinctive social situations can influence people to be more self-motivated and energized for specific tasks or responsibilities. The theory of self-determination (SDT) has evolved over the past few decades with the goal of investigating the social-contextual factors that facilitate versus hinder the natural processes of motivation as well as other healthy behavior development (Ryan & Deci, 2000).

The SDT is a psychological framework that was originally developed to explain individual differences in the quality of motivated behavior and subjective well-being. Since the origin of SDT, research evidence has consistently provided support for the role of SDT concepts of motives that regulate human behavior, such as the universal psychological needs for autonomy, competence, and relatedness. In addition, the SDT framework has become an important and emerging area of health behavior research. Therefore, SDT is considered as an appropriate model to apply to physical activity and exercise behavior.

Theoretical components. Deci and Ryan (1985) developed a motivational model for health promotion based on an organismic metatheory of self-determination. The central tenets of self-determination theory (SDT; Deci & Ryan, 1985) promote that humans have a natural tendency toward a unified sense of self (Deci & Ryan, 2002). SDT posits that psychological

growth can only occur when an individual is able to satisfy the three basic needs for autonomy, competence, and relatedness.

Autonomy is defined as the perceived ability to control and initiate healthy choices and behaviors (Williams, 2002). Competence is referred to as an individual's confidence in his or her ability to successfully achieve behavioral goals and outcomes. Finally, relatedness is described as the need to feel connected to and supported by one's social network. Thus, the SDT model highlights biopsychosocial factors that can optimize the satisfaction of basic needs in order to improve health and wellness (Ng et al., 2012). Ryan and Deci (2000) theorize that in order to be self-determined, individuals must find the means to fulfill these essential needs. By tapping into individual's innate propensity for vitality and growth, health professionals can better facilitate behavior change (Williams, 2002).

Autonomy. Within the framework of SDT, Deci and Ryan (1985) introduced a sub-theory, called organismic integration theory that describes various reasons why people can be motivated, which can be conceptualized on a behavioral regulation continuum of autonomy. Autonomy is defined as governing one's own decisions and actions (Ryan & Deci, 2002). However, this does not mean that individuals are making choices without input or support from others; autonomy is not synonymous with independence. Instead, it is referred to as the capacity to freely regulate motivation and behavior. Autonomy concerns behaving from an internalized motivation orientation, and it is considered a continuous process rather than a dichotomy between intrinsic and extrinsic motivation. Consequently, SDT theorists propose that behavioral regulations are broadly categorized as autonomous self-regulation, controlled regulation, and amotivation (Deci & Ryan, 2000). Autonomous motivation refers to three different types of behavior regulation: (1) intrinsic motivation, (2) integrated regulation and (3) identified

regulation (Ng et al., 2012). The most autonomous motivation is intrinsic motivation, which is described as engaging in an activity for the inherent pleasure, fun, or challenge it involves. Another autonomous form of motivation is integrated regulation, which is referred to as participating in activities that are in line with personal goals and values. The last autonomous motivation is identified regulation. A person who experiences a health activity as valuable or important to the self is said to have identified regulation of health behaviors. The second category of behavioral regulation - controlled regulation - encompasses: (a) introjected regulation and (b) external regulation. Introjected regulation occurs when internal pressures, such as guilt or shame, motivate an individual. Therefore, this form of motivation involves behavioral performance motivated by self-esteem related contingencies. The least autonomous type of motivation, external regulation, can occur when external pressures (e.g., rewards or punishment) encourage an individual's health behavior. The final category of behavioral regulation is amotivation, which occurs when an individual is described as having a relative absence of motivation for a certain behavior (Ryan & Deci, 2002).

Empirical studies indicate that autonomous self-regulation has significant effects on various health behaviors and outcomes (Ng et al., 2012). Research findings have demonstrated that autonomous motivation is significantly associated with positive social relationships, medication adherence, smoking cessation, diabetes management, weight control, exercise, and overall well-being (e.g., La Guardia, Ryan, Couchman, & Deci, 2000; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Williams, Niemiec, Patrick, Ryan, & Deci, 2009). For example, a recent study by Silva et al. (2011) found that autonomous regulation was positively related to exercise behaviors and weight reduction. In contrast, research literature also demonstrates that controlled regulation is significantly related to maladaptive health behaviors such as deception, false self-

identification, and defensive coping (e.g., Hodgins, Koestner, & Duncan, 1996; Hodgins & Knee, 2002; Knee & Zuckerman, 1998). Experimental studies have demonstrated that individuals can decrease levels of controlled regulation by priming autonomy (e.g., Hodgins, Brown, & Carver, 2007; Weinstein & Hodgins, 2009). For instance, Weinstein and Hodgins (2009) demonstrated that after providing cues for autonomy, participants showed better emotional regulation. Moreover, recent studies have also investigated the effects of autonomous regulation on physiological responses to challenges and threats. In 2010, a study by Hodgins et al. revealed that individuals who were randomly primed with autonomy showed less threat arousal than individuals from the controlled regulation condition. These combined findings reveal that behavioral regulation appears to have ubiquitous effects on health and wellness.

Competence. Competence is described as feeling capable and effective in the performance of healthy activities. It is similar to Bandura's operationalization of self-efficacy and outcome expectancy. However, Deci and Ryan (2002) emphasize that competence can only be achieved when health goals represent optimal challenges. When individuals continue to feel that they are developing and mastering capacities, they are more likely to strive to fulfill the need for competence.

Research studies have provided ample evidence to support that both self-efficacy and outcome expectancies are key indicators of health behavior change (Conner, 2008). For instance, numerous studies have indicated that self-efficacy and outcome expectancy are significantly associated with health outcomes, such as physical functioning, health-related quality of life, and overall adjustment (Chou et al., 2009). In addition, individuals with chronic pain that report higher levels of pain self-efficacy are more likely to experience reduced pain intensity, to use adaptive coping strategies, and to improve physical functioning (Vong, Cheing, Chan, Chan, &

Leung, 2009). Therefore, it is posited that an individual should fulfill the need for competency in order to enhance motivation to participate in healthy behaviors.

Relatedness. Relatedness meets the basic need to feel a sense of belonging and security. Relatedness is described as feeling supported and connected to important others in one's life (Deci & Ryan, 2002). Empirical studies reveal that perceived social support is associated with health outcomes, and it is commonly measured as receiving social support related to autonomy (Williams, 2008). Individuals with high levels of autonomy support feel that important social others influence them to make autonomous health decisions. For instance, a study by Milne, Wallman, Guilfoyle, Gordon, and Courneya (2007) found that high levels of perceived autonomy support from important others among breast cancer survivors was associated with perceived competence, intrinsic motivation to exercise, and self-reported exercise.

Perceived support from health care professionals is also often tested within intervention studies, and it is frequently operationalized through an assessment of patient views of healthcare provider's autonomy support (e.g., Health Care Climate Questionnaire [HCCQ]; Williams, Virgina, Zachary, Deci, & Ryan, 1996). Autonomy support in health care is described as providing clients with evidence-based choices and treatment rationale; supporting client perspective; facilitating self-management; and minimizing control from the practitioner (Williams, Lynch, & Glaslow, 2007). Research studies have supported the relationship between perceived autonomy support and positive health outcomes, such as better diabetes management (Williams et al., 1996; Williams, McGregor, Zeldman, Freedman, & Deci, 2004), smoking abstinence (Williams, Cox, Kouides, & Deci, 1999), and medication adherence (Williams, Rodin, Ryan, Grolnick, & Deci, 1998). Hence, when patients perceive autonomy support from their health care professionals, they are more likely to experience improved health (Williams,

2002). On the other hand, additional empirical studies have found that when individuals feel that they lack control over their health decisions, they are not able to satisfy their psychological health needs (Ryan & Deci, 2000).

Research evidence. A large body of research has provided support for the core aspects of the SDT model. More specifically, it has been suggested and empirically confirmed that self-determined motivation facilitates psychological adjustment, while non self-determined motivation leads to psychological dysfunction (Ryan, 1995). SDT has also become a popular framework for examining motivational issues in health behavior contexts. For instance, the SDT model has been extensively tested and validated on individuals in longitudinal studies on smoking cessation (Williams, Gagne, Ryan, & Deci, 2002), alcohol treatment (Ryan, Plant, & O'Malley, 1995), medication adherence (Williams, Rodin, Ryan, Grolnick, & Deci, 1998), and weight loss (Williams, Grow, Freedman, Ryan, & Deci, 1996). The results have consistently demonstrated that fulfillment of the three basic needs significantly predicted whether individuals were likely to initiate and maintain health behavior change.

There also appears to be practical importance of SDT in explaining the motives for the exercise and physical activity domain of health behaviors. Cross-sectional studies have demonstrated that self-determined motivation distinguishes physically active from inactive adults (Landry & Solomon, 2004; Markland, 1999). For instance, SDT constructs have predicted greater frequency of weekly exercise participation (Wilson et al., 2004), and have explained the reasons behind the maintenance of physical activities (Pelletier et al., 2001). Another study by Edmunds et al. (2006) found that satisfaction of the three basic psychological needs was significantly related with life satisfaction, positive affect, and physical activity levels among overweight individuals who participated in an exercise program. These and other research

studies suggest the applicability of SDT to physical activity and exercise participation (Wilson et al., 2006).

A recent meta-analysis by Ng et al. (2012) supported the positive associations among SDT constructs, in addition to significant relationships between SDT constructs and positive mental health (ρ = .22 to .62) and physical health (ρ = .07 to .67) outcomes. Furthermore, in the same study, Ng et al. combined techniques of meta-analysis and path analysis to test the overall SDT model for health behavior. The authors reported that the model showed a good fit, $\chi 2(3) = 76.25$, $p < .01$, CFI = .98, RMSEA = .07, SRMR = .03. Hence, these research findings supported the key features of an SDT perspective on health promotion. A systematic review also provided consistent results, showing evidence for a positive relationship between more autonomous forms of motivation and physical activity and exercise (Teixeira, Carraca, Markland, Silva, & Ryan, 2012). Moreover, perceived competence and more internalized motives were found to predict exercise participation across a range of samples and settings. Mixed evidence was found with regards to the specific nature and consequences of introjected regulation. The majority of studies have utilized descriptive designs but similar results are found across cross-sectional, prospective, and experimental designs.

One current study utilized an experimental design to investigate the effectiveness of an 8-week, SDT-based exercise intervention with a total of 50 sedentary overweight/obese women (Hsu, Buckworth, Focht, & O'Connell, 2013). Women were randomly assigned to either the SDT-based intervention or exercise-only intervention. The results indicated that adherence to physical activity goals were better for the SDT-based intervention group. Moreover, the SDT intervention resulted in larger effect sizes for changes in self-determination, autonomy, in addition to goal-setting, planning and scheduling self-efficacy. Another study also investigated

the cost-effectiveness of tobacco dependence intervention based on the SDT, and the results indicated that smokers showed improved autonomy, competence, and tobacco abstinence with a total cost of approximately $1,200 per quality-adjusted life-year saved (Pesis-Katz, Williams, Niemiec, & Fiscella, 2011). This cost estimate is encouraging when compared to the costs of $3,500 per life-year saved with other tobacco dependence interventions. Therefore, not only have SDT interventions shown to be effective, but also they may have the potential to improve the cost-effectiveness of health promotion interventions.

Limitations. Numerous research studies have provided evidence for the capacity of the motivational constructs of the SDT framework to significantly predict health-promoting behaviors, such as physical activity and exercise participation (e.g., Edmunds et al., 2006; Moreno, Cervello, & Martinez, 2007; Rouse, Ntoumanis, Duda, Jolly, & Williams, 2011; Silva et al., 2008). However, there is a dearth of studies integrating SDT with traditional social-cognitive theories in order to predict health behaviors, especially for individuals with chronic illness and disability (McBride et al., 2010; Russell & Bray, 2010; Williams, McGregor, Zeldman, Freedman, & Deci, 2004). There also has not been a study investigating the role of SDT constructs in the physical activity behaviors of individuals with chronic pain. Hence, there is a critical need to apply SDT models to diverse rehabilitation populations in empirical studies.

There are also theoretical shortcomings to the SDT framework. Although research studies have revealed that the SDT model can explain the motivational processes for health activity, authors have argued that the SDT does not adequately predict how individuals transition from a motivational to action state (e.g., Haggar, Chatzisarantis, Culverhouse, & Biddle, 2003). Recently, it has been suggested that integrating traditional social-cognitive theories with the organismic motivational theory of SDT may help to enhance the predictive value of the health

behavior models (Hagger et al., 2011). Researchers speculate that the theory of planned behavior has the potential to complement the SDT explanation for health behavior engagement (Haggar et al., 2003). More specifically, the autonomous and controlled forms of motivation are considered distal predictors of health behavior, while attitude, subjective norm, and PBC are viewed as proximal predictors. The reason for this proposed sequence of effects is that SDT variables are operationalized as generalized motivational orientations towards acting in a specific context, while social-cognitive variables from the TPB emphasize a particular action (Chan & Hagger, 2012). A recent meta-analysis reviewed previous studies (the vast majority of studies included physical activity as an outcome variable) that integrated SDT with TPB constructs and reported that the expanded health promotion model accounted for 58% of the variance in health behavior (Hagger & Chatzisarantis, 2009).

Despite the fact that research studies has endorsed the utility of SDT and TPB in predicting physical activity behavior, both theories have limitations when integrated into a multi-dimensional health promotion model (Hagger & Chatzisarantis, 2009). A complementary SDT and TPB model does not describe how the distal factors of SDT influence intentions via the mediation of the more proximal variables from the TPB, or how proximal factors like action/coping planning influence the actual implementation of behaviors. With additional research focus on these unanswered questions, an integrated model of SDT and TPB may further elucidate the theoretical weaknesses of both frameworks and provide a more complete account of the motivational and social-cognitive processes that determine behavioral intentions, and subsequently, actual health behavior (Chan & Hagger, 2012). The present study is proposing an integrative and extended SDT model for individuals with chronic musculoskeletal pain that would incorporate components of previously tested and validated social-cognitive theories on

health promotion that include the following: social-cognitive health theory (SCT; Bandura, 1977, 1997, 2004), theory of planned behavior (TPB; Fishbein & Ajzen, 1975), transtheoretical model (TTM; Prochaska & DiClemente, 1983), and health action process approach (HAPA; Schwarzer, 1992).

Social Cognitive Health Theory

The renowned Stanford psychologist, Albert Bandura, developed the theory of social cognition in 1987. Social-cognitive health theory (SCHT; Bandura, 1986, 1997) is a theory of behavior change that suggests that health behaviors must be understood in the context of triadic reciprocality (Chou, Ditchman, Pruett, Chan, & Hunter, 2009). The theory of triadic reciprocality proposes that personal factors, environment, and behavior interact in order to determine whether a health behavior is performed (Bandura, 2004). Bandura proposes that personal factors alone do not determine an individual's actions; instead, health behaviors are influenced by a dynamic interaction of contextual factors.

Evolving from the triadic reciprocality theory, Bandura (2004) delineated five determinants of change for behavior: (a) information (knowledge of the positive and negative consequences of behavior); (b) self-efficacy (confidence to complete actions); (c) outcome expectancies (understanding the risks and benefits of behavioral actions); (d) goals (aspirations to complete health behaviors); and (e) impediments and facilitators (physical or invisible barriers to actions). The initial behavior determinants (i.e., information, self-efficacy, and outcome expectancies) are predicted to motivate and influence a person's intention to formulate a goal. Motivational influences can also impact an individual's perception of health barriers and facilitators. Research indicates that SCHT constructs are significant predictors of health behaviors such as, smoking cessation, addictive behaviors, diet, and exercise (e.g., Bandura,

1997; Borrelli & Mermelstein, 1994; Rodgers et al., 2002; Schnoll & Zimmerman, 2001; Wang, Wang, & Hsu, 2003).

Among the behavioral determinants, SCHT proposes that the essential component of health behavior change is self-efficacy because of its direct effect on motivation, behavior, and other determinants (Bandura, 1997, 2004). Bandura (1977) first conceived of the concept of self-efficacy that is now a fundamental ingredient in most health behavior theories. Perceived self-efficacy is described as the individual's confidence in being able to efficiently complete a task or activity. The development of self-efficacy was strongly influenced by Miller and Dollard's (1941) social learning theory, as Bandura posits that individuals acquire self-efficacy through observing others, testing out behaviors, and learning over time (Chou et al., 2009). And according to SCHT, if individuals believe that they can successfully participate in an activity, then they will be more motivated to adopt and maintain healthy behaviors.

Self-efficacy has been widely applied in empirical studies on diverse health behaviors (Chou et al., 2009). In particular, numerous studies have applied the construct of self-efficacy to health promotion models for physical activity (e.g., Chiu, Lynch, Berven, & Chan, 2011). For example, an online study assessed the exercise patterns of 265 undergraduate students during two-week periods (Scholz, Keller, & Perren, 2009). The results demonstrated that self-efficacy (along with outcome expectancy) was positively associated with intentions for physical exercise. Furthermore, recent studies have shown that self-efficacy interventions facilitate change by encouraging effortful action and maintenance of health behaviors (Luszczynska, Tryburcy, & Schwarzer, 2007). Therefore, it is argued that the construct of self-efficacy is not merely a readiness indicator.

SCHT suggests that, in addition to maintaining self-efficacy, an individual must also

believe that engaging in the behavior will lead to desirable outcomes, which are referred to as outcome expectancies (Bandura, 2004). There are three different types of outcome expectancies: (1) physical outcome expectancy, (2) social outcome expectancy, and (3) self-evaluative outcome expectancy (Bandura, 1997). Physical outcome expectancy is described as an individual's expectation of what physical responses will occur after behavior change. Social outcome expectancy is defined as the belief that health behaviors will receive certain reactions from others, such as solicitous social support. Self-evaluative outcome expectancy refers to the expected self-perception after engaging in health behaviors. For example, individuals may feel more or less satisfied with their abilities after participating in physical activity. Conner (2008) asserts that an individual's self-evaluative expectancies (e.g., anticipated guilt, anxiety, or fear) deserve particular attention as predictors of a health behavior intention, because these variables can serve as status indicators of a self-regulatory activity.

Research studies have provided generous evidence to support outcome expectancies as key indicators of health behavior change (Conner, 2008). However, most studies include both self-efficacy and outcome expectancy. For example, countless research studies have indicated self-efficacy and outcome expectancy are significantly associated with health outcomes, such as physical functioning, health-related quality of life, and overall adjustment (Chou et al., 2009). And according to Bandura (2004), individuals are most likely to engage in a health behavior if they possess the perceived ability to perform the behavior (self-efficacy), as well as the belief that engaging in the behavior will lead to desirable outcomes (outcome expectancies). Future studies should aim to incorporate the key social-cognitive variables in addition to measures on perceived environmental resources.

Theory of Planned Behavior

In 1974, Fishbein and Ajzen originally established the theory of reasoned action. In the theory of reasoned action, it is posited that intentions largely predict specific health action (Ajzen, 1985). Research studies consistently support the important role of intentions in determining health behaviors (Conner, 2008; Connor & Norman, 2005). Intentions to engage in health behavior are considered to be personal goals that can be either self-imposed or imposed by others (Ajzen, 1985). Once a deliberative intention is formulated, individuals are motivated to begin to take action and change, adopt, or manage given health behaviors (Hagger & Armitrage, 2004). Hence, a behavioral intention is propagated as the most proximal predictor of health action, and it is considered an explicit action plan statement. Nonetheless, researchers are skeptical of intention acting as a reliable predictor variable due to fluctuations in its theoretical potency for behavioral change models (Schwarzer, 2008). A person's intention can vary greatly from day-to-day, yielding invalid data results; consequently, this can lead to misclassification in research studies. Given that this theory is applied to a certain behavioral situation, it provides an ambiguous view of the motivational processes underlying general health behaviors. Ajzen (1991) asserted that it should be viewed as a flexible theoretical framework for health behavior research, which means it can be receptive to the incorporation of other constructs.

The theory of reasoned action later evolved into the theory of planned behavior (TPB; Ajzen, 1988, 1991) by incorporating the health determinant of perceived behavioral control. TPB postulates that the intention to perform a behavior is determined by an individual's attitude, subjective norm, and perceived behavioral control regarding that behavior. Attitudes refer to the perceived likelihood for and appraisal of consequences to performing a health behavior (Ajzen, 1985). An individual's evaluation of outcomes can facilitate or deter behavioral change.

Subjective norms are based on normative beliefs or social pressure to carry out the behavior. Hence, individuals may feel more inclined to participate in healthy activities if their social group is supportive of this effort. Finally, perceived control is determined by control beliefs. Control beliefs are defined as the perceived ease or difficulty in changing health behaviors. Therefore, an individual who believes that there are multiple barriers to adopting healthy behaviors may not follow through with health behavior change.

The TPB has been widely used for assessing and determining health behavior outcomes. Numerous meta-analytic studies confirm the importance of TPB constructs in explaining and predicting various health behaviors, such as health screening behaviors or condom use (e.g., Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Cooke & French, 2008). The TPB has also proven to be a valuable framework for understanding physical activity in the general population (e.g., Hagger, Chatzisarantis, & Biddle, 2002; McEachan, Conner, Taylor, & Lawton, 2011). Furthermore, preliminary studies applying TPB constructs have helped to explain the physical activity of individuals with disabilities, including cardiovascular disease (e.g., Blanchard et al., 2003), spinal cord injury (Latimer & Martin Ginis, 2005), and peripheral arterial disease (Galea & Bray, 2006). Despite the success of the TPB, a recent meta-analysis by Rhodes and Dickau (2012) reported that there might be a theoretical knowledge gap between intention and behavior variables in the TPB model. The authors aggregated findings from experimental studies, and as a result reported Cohen's *d* instead of *r*. They reported a medium effect size (.45) for intention, but a small effect size for behavior (.15). Therefore, a weak relationship was demonstrated between intention and physical activity. They were not able conduct a moderator analysis due to small sample size, but suggested that future research should incorporate self-regulatory variables in order to explain the intention-behavior gap. Other research has shown that the impact of the TPB

constructs is significantly reduced with the inclusion of past health behavior in the model (Bagozzi & Kimmel, 1995; Norman & Conner, 1996). These combined findings suggest that the theory is incomplete and that additional variables should be included in the theory to further explain health behavior change.

Transtheoretical Model

The transtheoretical model (TTM; DiClemente & Prochaska, 1982; Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992) is a comprehensive, stage-based health behavior theory. It incorporates constructs related to self-efficacy, decisional balance, processes of change, and stages of change. The TTM construct for self-efficacy is similar to Bandura's (1987, 1997) original description of self-efficacy, but it also emphasizes the ability to recover self-efficacy when in difficult situations or relapses in health. The construct of decisional balance also builds on Bandura's social-cognitive theory (i.e., outcome expectancy). Decisional balance refers to an individual's ability to understand the pros and cons of behavioral change, including consideration of subsequent outcomes (Prochaska et al., 1992). In TTM, there are also approximately 8 to 10 common processes of change that explain how individuals modify unhealthy behaviors (Norcross, Krebs, & Prochaska, 2011). The different change processes are generally categorized into multiple techniques and strategies related to various theoretical methods. Earlier in the change process, cognitive-affective processes are often utilized that emphasize raising awareness and control of thoughts, feelings, and goals related to health. During later stages of action, behavioral change processes are implemented that encourage adoption of coping strategies or substitute behaviors related to enhancing overall health and wellness. Finally, the most commonly applied constructs from this model focus on assessing and predicting an individual's stage of health behavior change. TTM includes five stages of

readiness: (1) precontemplation, (2) contemplation, (3) preparation, (4) action, and (5) maintenance.

Precontemplation is described as the initial phase of the stages of change (Prochaska et al., 1992). Individuals in precontemplation are not considering change in the foreseeable future and, if they are confronted with their health problem, they may display feelings of denial or frustration (Norcross et al., 2011). Contemplation is the stage of change when a person may begin to think about changing unhealthy behavior. Individuals may start to find discrepancies in their behaviors or goals, which may lead them to consider resolving those discrepancies. The next stage is preparation. This phase of change occurs when a person is searching for additional knowledge and guidance on a health situation. Education and support may deter them from continuing the unhealthy behavior, and they may begin planning to terminate or change their behaviors in the near future. Action is the stage when a person may quit a behavior and/or substitute a new healthy behavior by finding alternative activities or habits. The action stage requires significant effort to successfully maintain healthy behaviors for a longer period of time. Maintenance is the final stage that occurs during the stages of change. This stage commences when an individual has adopted new health behaviors for longer than six months. However, this stage may not be permanent, and individuals are still at risk for relapse during the maintenance stage. Therefore, individuals may find it beneficial to develop relapse prevention plans (Marlatt & Gordon, 1985).

According to the TTM, health behavior change is a process involving stages that take place gradually, and not necessarily in a linear or consistent fashion (Lynch & Chiu, 2009). A person may start in contemplation and transition quickly to action but may regress back to preparation prior to permanently ending maladaptive behavior. For example, a meta-analysis on

physical activity and exercise found that self-efficacy was related to stages of change, but in a non-linear fashion (Marshall & Biddle, 2001). The majority of the self-efficacy process activity occurred during the transitions from pre-contemplation to contemplation stages (medium effect sizes), and the contemplation to preparation stages (large effect sizes). Another meta-analysis on health behaviors found that stage processes differ across groups (Rosen, 2000). People who were in a smoking cessation group showed the most cognitive-affective processes during initial stages, but during later stages they performed more behavioral activities. Substance abuse groups showed inconsistent change processes. Alternatively, people who were in the diet and exercise groups show cognitive and behavioral processes throughout the stages. The researchers speculated that this may have occurred because people who are changing their eating or exercise habits, are replacing old habits with new habits.

Research studies have demonstrated that the TTM is a useful framework for assessing an individual's motivation to change unhealthy behaviors and sustain healthy behaviors (e.g., Blissmer & McAuley, 2002; Lippke, Ziegelmann, & Schwarzer, 2005). In addition, meta-analyses and other empirical reviews have successfully applied TTM constructs to different groups of chronic illness and disability, such as substance abuse disorders, eating disorders, mood disorders, and cardiovascular disorders (e.g., Norcross et al., 2011; Rosen, 2000). A recent meta-analysis by Norcross et al. aggregated findings from 39 experimental studies (a total of 8,238 participants) applying TTM constructs. The study purpose was to investigate the impact of pretreatment stage of change on psychotherapy outcomes. Results indicated a significant medium effect size of $d = .46$ with a 95% CI of .35 to .58. Accordingly, the level of treatment progress was associated with pretreatment stage of change. For example, a study implementing an action- and maintenance-oriented smoking cessation program for cardiac patients achieved success for

22% of precontemplators, 43% of the contemplators, and 76% of those in action or preparing for action prior to treatment (Ockene et al., 1992). Therefore, the TTM appears to be a useful framework for assessing and predicting various health treatment outcomes.

Health Action Process Approach

A comparatively recent health behavior theory is the health action process approach (HAPA; Schwarzer, 1992), which posits that the adoption and maintenance of health behaviors can be explained as a process composed of a motivational phase and a volitional phase (Conner, 2008). The motivational phase can lead a pre-intentional individual to develop goal-setting behavior, while the volitional phase is divided into two stages: intentional and action stages. The intentional stage is defined as when an individual is intending to perform a health behavior but remains inactive, and the action stage is described as regularly engaging in health behaviors. This stage-based approach to health behavior assessment is similar to the conceptual framework of the stages of change theory (SOC; Prochaska, DiClemente, & Norcross, 1992), but HAPA is considered a more parsimonious model (Abraham, 2008).

In order to assess the motivational phase, the HAPA proposes the evaluation of an individual's level of action self-efficacy, outcome expectancies, risk perceptions, and intentions (Conner & Norman, 2005). This is consistent with previous health behavior theories (e.g., social-cognitive theory, theory of planned behavior). During the volitional phase, however, the HAPA model has an enhanced focus on post-intentional variables. These variables include: maintenance self-efficacy, recovery self-efficacy, action/coping planning, in addition to assessing the actual target health behavior. The HAPA theory is hypothesized to be useful in addressing the gap between intention and behavior in previous health behavior models (Sutton, 2008). While previous models describe the direct relationship between intentions and behaviors, the HAPA

includes additional moderators, such as phase-specific self-efficacy, between the intentions and behaviors of the volitional phase. Therefore, the HAPA model attempts to comprehensively elucidate the stage transitions of both the motivational and volitional processes (Connor, 2008). Applications for the HAPA model include several health-promoting goals, such as dieting (Renner, & Schwarzer, 2005), exercise (Sniehotta, Scholz, & Schwarzer, 2005), smoking (Schwarzer & Luszczynska, 2008), drinking (Murgraff, McDermott, & Walsh, 2003), condom use (Schwarzer & Fuchs, 1995) and breast self-examination (Luszczynska, 2004). In 2008, Schwarzer validated the HAPA as a health behavior model in a series of studies and the results confirmed that HAPA constructs are predictive of exercise, drinking, and diet behavior.

Recent studies have incorporated HAPA theories in order to test its effectiveness in assessing and predicting physical health behaviors for individuals with CID. For example, Sniehotta, Scholz, and Schwarzer (2005) conducted a 4-month longitudinal study on 307 individuals with cardiac illnesses who were encouraged to adopt or maintain regular exercise. The results demonstrated that self-efficacy and other social-cognitive variables mediated between exercise intentions and exercise behavior. Task self-efficacy, outcome expectancies, and risk perception explained 65% of the variance in intentions. Maintenance self-efficacy was a substantial predictor of action planning and exercise behavior. Maintenance self-efficacy and action planning explained 24% of the variance in exercise. Another study by Chiu, Lynch, Berven, and Chan (2011) tested the applicability of the HAPA model for the physical activity management of people with multiple sclerosis (MS). The results of this study showed that a respecified HAPA model explained 38% of the variance in physical activity. Action self-efficacy, maintenance self-efficacy, and recovery self-efficacy directly or indirectly affected physical activity. In addition, severity of MS and action self-efficacy had an inverse relationship

with perceived barriers, and perceived barriers influenced physical activity. A follow-up study also determined that the motivational and volitional variables identified in the HAPA model could be used to differentiate people with MS in different stages of change for physical activity (Chiu, Fitzgerald, Muller, Brooks, & Chan, 2012). The results demonstrated that participants in the precontemplation, contemplation, and action groups could be separated by volitional and motivational stages, providing additional support for utilizing HAPA to describe the health behavior change process for people with MS. Since the HAPA model integrates the key concepts of other health behavior theories and adds new post-intentional variables, it may have the potential to help further explain the health-promoting behaviors of people with a variety of disabilities.

Contextual Factors in Health Promotion

Individuals with disabilities engage in processes of thinking, feeling, and behaving within distinctive contexts. The field of rehabilitation has long advocated for understanding the person with a disability within a surrounding circumstance (Wright, 1988). For instance, the ICF model (WHO, 2001) emphasizes the importance of evaluating and describing contextual factors in health promotion research and practice (Mpofu & Oakland, 2010). The ICF model highlights contextual factors that include a variety of personal and environmental characteristics (Smart, 2001).

The numerous contextual factors can have a substantial impact on an individual's participation in society, and thus are strongly implicated in the success of rehabilitation efforts (Scherer & Glueckauf, 2005). This section will specifically cover the personal and environmental factors that are relevant to the lives of people with chronic musculoskeletal pain.

Personal Factors

Personal factors are defined as an individual's coping style, age, gender, race/ethnicity, or other personal characteristics (Mpofu & Oakland, 2010). These characteristics are important to consider in rehabilitation because empirical studies have demonstrated that they can facilitate or impede an individual's ability to engage in healthy activities. For example, individuals with adaptive features, such as hope beliefs, endorse reduced depression and better disability adjustment (e.g., Elliot, Witty, Herrick, & Hoffman, 1991). On the other hand, individuals with maladaptive coping strategies, such as avoidance behaviors, tend to have poorer outcomes in rehabilitation (e.g., Hill & Kennedy, 2002). This subsection will review personal factors that are often experienced by individuals with chronic pain.

It is common for chronic pain patients to maintain negative distorted interpretations of pain, such as catastrophizing. Pain catastrophizing is described as exaggerated negative orientation toward pain or anticipated pain (Sullivan, Bishop, & Pivik, 1995). Extensive literature reviews and longitudinal research studies have consistently found that pain catastrophizing is associated with increased psychological distress, pain intensity, and functional disability (Edwards et al., 2011; Smeets et al., 2006). Thus, individuals who ruminate about pain outcomes are less likely to spend time engaging in adaptive coping strategies, such as physical activity. For instance, Keefe, Brown, Wallston, and Caldwell (1989) found that individuals with rheumatic arthritis who had more catastrophizing thoughts also had higher levels of pain and physical disability. Studies have also demonstrated that catastrophizing may be involved in the development and maintenance of chronic musculoskeletal pain (e.g., Edwards et al., 2011). Finally, individuals who catastrophize report higher rates of health care usage and pain medications than those who do not catastrophize (Keefe et al., 2004). Despite the ample research

on pain catastrophizing, relatively little is known about the conditions needed for it to occur since not everyone in pain endorses catastrophic thinking. Preliminary studies have revealed that catastrophizing may serve as an interpersonal form of coping (e.g., Giardino, Jensen, Turner, Ehde, & Cardenas, 2003). Individuals in pain may attempt to communicate their difficulties to others in order to solicit assistance. A study by Giardino et al. (2003) demonstrated that catastrophizing was linked to solicitous support, and that the association was stronger for those who lived with a partner or spouse. From the pain literature, it can be concluded that pain catastrophizing plays a major role in the overall pain experience for individuals with maladaptive coping strategies.

In the pain and broader rehabilitation literature, there are several multidimensional definitions of resilience used to describe the personal coping experiences of individuals with chronic pain, but no mutually agreed upon construct (Catalano, Chan, Wilson, Chiu, & Muller, 2011). However, it is broadly referred to as an individual's successful adaptation after a crisis, adversity, or other major stressful event (Johnson et al., 2011). When faced with a distressing situation, individuals may be predisposed to a host of risk factors and protective resources - if immunities outweigh vulnerabilities, there is an increased likelihood for resilient functioning (Kumpfer, 1999).

There is limited research on chronic pain and resilience, but authors have suggested that there are three main components involved with the resilient responses to pain: (1) recovery (e.g., ability to bounce back to homeostasis), (2) sustainability (e.g., developing and seeking meaningful goals), and (3) growth (e.g., learning about self and enhancing competence) (Zautra, 2009). Vulnerability factors for individuals with chronic pain may include history of trauma, mood disorders, maladaptive cognitions, and limited or unconstructive social exchanges (Yeung,

Arewasikporn, & Zautra, 2012). On the other hand, protective factors for individuals with chronic pain may entail various resources, such as: benefit finding, intelligence, optimism, active coping strategies, strong social network ties, family support, and other adaptive sources. Historically, researchers have focused on the risk factors for pain that are associated with poorer mental and physical functioning. Yet, in recent years, there has been emerging interest in investigating the protective factors that may help to foster resiliency in chronic pain patients.

Pain acceptance is described when a person responds to the painful experience without attempting to control or avoid the pain (Fish, McGuire, Hogan, Morrison, & Stewart, 2010). Closely related, it may involve participating in important activities of daily functioning that may exacerbate or cause pain. It may also require discontinuing avoidance or passive behaviors, such as sedentary activity, in order to prevent pain. Therefore, pain acceptance can be conceptualized as an active coping method for individuals with chronic pain. Empirical studies have found that individuals who endorse pain acceptance beliefs show decreased pain, improved functioning, and better disability adjustment (McCracken & Eccleston, 2003; McCracken et al., 1999). For instance, a study by Esteve, Ramírez-Maestre, and López-Martínez (2007) found that chronic pain patients with higher levels of pain acceptance beliefs were more likely to have a better functional status.

Recently, SDT theorists (Ryan & Deci, 2008) have hypothesized that the personal trait of mindfulness may help to foster autonomous regulation of health behavior. Mindfulness is defined as the self-regulation of attention to facilitate present awareness of bodily sensations, thoughts, and emotions, which in turn, is acknowledged with curiosity, openness, and acceptance (Bishop et al., 2004; Kabat-Zinn, 1990). An underlying assumption of mindfulness is that most individuals operate their lives on “autopilot” as they are often unaware of their moment-to-

moment experiences (Grossman, Ludger, Stefan, & Walach, 2004). Through mindful awareness, individuals may be able to better process life experiences in order to facilitate the organismic integration of motivation, personality, and behavior (Ryan & Deci, 2008). For example, individuals may transition from external regulation of physical activity behavior to autonomous regulation after increasing focus on values, emotions, and sensations related to fitness and health. Preliminary studies reveal that greater mindfulness is associated with autonomous regulation and positive emotional states (Brown & Ryan, 2003). Furthermore, several meta-analyses reveal that mindfulness-based stress reduction (MBSR) programs for individuals with chronic pain disorders have uncontrolled effect sizes between d = .25 to .70 (Baer, 2003; Grossman et al., 2004). Namely, individuals with chronic pain with high levels of mindfulness show improved physical, mental, and functional ability (Grossman et al., 2007). A recent study rigorously compared an 8-week MBSR intervention to a matched active condition, the Health Enhancement Program, among individuals with chronic inflammatory conditions, such as rheumatoid arthritis (Rosenkranz et al., 2013). While both interventions were equally effective in reducing stress, the MBSR approach was more effective in decreasing stress-induced inflammation.

Environmental Factors

Personal and environmental factors are not easily disentangled; however, environmental variables are described as primarily influences external to an individual (Mpofu & Oakland, 2010). Not only can these include physical environment factors, but also they can include social, family, provider, community, work, or cultural environmental variables. It is also invaluable to consider these variables because they can have a significant impact on rehabilitation outcomes. For example, individuals with strong social support have been shown to have lower mortality rates and overall better health outcomes (Chronister, 2009). In contrast, individuals in acute

rehabilitation settings with lower levels of family support tend to endure longer recovery times (Mpofu & Oakland, 2010). There are also studies that show that individuals with significant disabilities may be faced with negative stereotypes within a given culture, which ultimately diminishes their quality of life (Corrigan & Penn, 1999). Consequently, it is important to consider multiple environmental layers. There are available instruments to assess social, family, and cultural environmental variables; however, there is a scarcity of measure instruments for the physical environment (Reed et al., 2005).

One environmental factor that may have a significant impact on the physical activity and exercise behaviors of individuals with chronic pain is social support. Perceived social support for physical activity and exercise is described as an environmental factor specific to exercise-related behaviors. Although a substantial number of studies have demonstrated the beneficial effects of social support on exercise and other health-related behaviors (e.g., Carron, Hausenblas, & Mack, 1999; Courneya, Plotnikoff, Hotz, & Birkett, 2000), there have been only limited investigations of the effects of exercise-specific social support. However, the few available studies have reported that friend and family support for exercise is related to participation in exercise (e.g., Eyler et al., 1999; Sallis, Grossman, Pinski, Patterson, & Nader, 1987; Treiber et al., 1991). For example, Eyler et al. found that women with higher levels of family and friend social support for physical activity were less likely to be sedentary. Additional research should investigate the effects of social support for physical activity and exercise in order to provide more information on this contextual factor.

Conclusion

This literature review has highlighted the unmistakable need to bolster health promotion resources, interventions, and support for individuals with disabilities, yet there is a dearth of

empirical studies in this area. More specifically, the pain and rehabilitation literature indicates the critical need to advance health-promoting strategies for the physical activity and exercise behaviors of individuals with chronic pain to improve treatment retention rates, health outcomes, and overall cost-effectiveness. Despite the fact that evidence indicates physical activity and exercise can reduce pain, prevent secondary health conditions, and improve health-related quality of life, individuals with chronic pain struggle with adhering to exercise programs. Preliminary research studies have investigated and validated the use of self-management methods in order to promote effective healthy coping behaviors among people with chronic pain. Although SDT-based studies have not yet been applied to people with chronic pain, there is generous evidence supporting the central tenets of the SDT perspective on health promotion and research demonstrating the cost-effectiveness of SDT-based health promotion methods (Kratz et al., 2011; Molton et al., 2008; Pesis-Katz et al., 2011; Williams, 2002). Accordingly, the collective findings demonstrate that SDT approaches may improve both the efficacy and cost-effectiveness of health promotion interventions.

Current health promotion efforts are expanding upon an ecological definition of health and disability by promoting its usefulness in order to reinforce the necessity to address the contextual elements of health (Drum et al., 2009). Chronic pain should be defined with a biopsychosocial framework in order to examine the influence of and interaction between biological and psychosocial factors (Williams et al., 2007). This study will evaluate a multi-dimensional, holistic health promotion model based on an integrative and extended SDT perspective in an attempt to better understand and predict the pain self-management strategy of physical activity and exercise participation. With better self-management strategies, individuals with chronic musculoskeletal pain may learn to autonomously regulate, cope, and live with

disability. Considering the value assigned to the basic need for autonomy, an SDT approach is also consistent with ethical standards of the rehabilitation profession. To this end, a person-centered, comprehensive biopsychosocial framework on health promotion, such as the SDT model, is an important topic for study that may further explain the health and wellness of individuals with disabilities.

CHAPTER THREE

Methodology

A quantitative descriptive design (Heppner, Wampold, & Kivlighan, 2007), utilizing hierarchical regression and correlational analysis, was used to investigate the ability of the health-promoting variables of an integrative and extended self-determination model to predict participation in physical activity and exercise for individuals with chronic musculoskeletal pain. The following section will review the sample and procedures; measurement instruments and psychometric properties; and the statistical analyses.

Sample and Procedures

Responses were collected from 211 participants from the following community or clinic networks: (a) Midwest churches; (b) Midwest pain, physical therapy, and primary care clinics; and (c) national chronic pain and fibromyalgia support groups. To be eligible for this study, the participants were required to be: (1) diagnosed with chronic musculoskeletal pain, (2) at least 18 years or older, (3) have pain that is nonmalignant, (4) living with pain for longer than 3 months, and (5) able to engage in some type of physical activity and exercise.

Participants were recruited by advertisements through newsletters, bulletins, and recruitment flyers between November 2013 and February 2014. Prospective participants were invited to complete an online questionnaire on SurveyMonkey at the following website: https://www.surveymonkey.com/s/THBCZWW. The content of questionnaires was identical for all clinic and community networks. Participants also had the option to receive a $15 gift card after completing the online survey, and their contact information was kept confidential by automatically transmitting that information to a file separate from their survey data.

Upon receiving approval of the University of Wisconsin-Madison Social and Behavioral Sciences Institutional Review Board (IRB) to conduct this study, Midwest churches were contacted in the fall of 2013 for assistance in announcing the study through newsletters, flyers, and bulletins in order to recruit participants interested in the study. Church staff members provided written letters of support to be included in the IRB application at the University of Wisconsin-Madison. Due to a low response rate, Midwest pain, physical therapy, and primary care clinics were contacted in November of 2013. Clinic staff members provided written letters of support to be included in an amended IRB application. After several months, the response rate was still low, and the IRB application was revised again to include support groups as recruitment sites and consequently approved at the University of Wisconsin-Madison. In January 2014, national chronic pain and fibromyalgia support group facilitators were contacted to help promote the survey. In February of 2014, the sample size reached the sampling frame for this study – over 150 individuals with chronic musculoskeletal pain. According to SurveyMonkey's response summary, there were a total 253 individuals who started the survey. However, there were 218 who completed the survey. The total completion rate was 83% of those individuals who started the survey. The research packet including the IRB approval letter (see Appendix A), the cover letter for the online survey (see Appendix B), the announcement (see Appendix C), the survey flyer (see Appendix D), and the survey (see Appendix E) may be found in the Appendix section.

Participant Characteristics

Descriptive data for the participants are presented in Table 3.1. Participants ranged in age from 18 to 82 years ($M = 43.4$, $SD = 14.4$). The majority of the participants were female (86.7%) and the majority of the sample described themselves as European American (89.1%), followed by African American (4.3%) and Native American (2.4%). Over 98% of the

participants had completed high school and over half (59.7%) had earned a college degree. Nearly half of the participants were married or in a significant long-term relationship (59.7%). Participants describing themselves as single were the next largest percentage (27.0%), followed by divorced (10.0%) and widowed (1.4%). The median annual household income for participants was $42,500 (*M* = $48,425, *SD* = $46,455). In regard to employment, 41.2% were employed either full-time or part-time. The next largest percentages were individuals who described themselves as retired or not seeking employment (36.5%), those seeking employment (16.1%), and those volunteering (5.6%). The current or most recent career category most often selected was 'professional' (48.3%), followed by 'student' (15.6%) and 'service worker' (9.0%). Regarding body mass index, the largest percentage of participants was in the obese weight category (45.0%), followed by 'normal weight' (30.3%) and 'overweight' (23.7%). Approximately 55% of the participants reported having fibromyalgia, while 45% reported having another type of chronic musculoskeletal pain condition (additional demographic information for the specific groups are in Appendix F). Participants ranged in level of pain intensity from 1 to 10 on a 0-10 pain rating scale (*M* = 6.2, *SD* = 1.9). The average participant was diagnosed with a chronic musculoskeletal pain condition at mean of approximately 13 years ago (*SD* = 9.8) at the mean age of 30 (*SD* = 12.5).

Table 3.1
Demographic and Disability-Related Characteristics ($N = 211$)

Variable	*n*	(%)	*M*	*(SD)*
Age			43.4	(14.4)
Gender				
Female	183	(86.7)		
Male	28	(13.3)		
Race/ethnicity				
African American	9	(4.3)		
Asian American	2	(0.9)		
European American	188	(89.1)		
Latino	1	(0.5)		
Native American	5	(2.4)		
Other	3	(1.4)		
Education level				
Grade school	2	(1.0)		
Some high school	2	(0.9)		
High school graduate	18	(8.5)		
Some college	63	(29.9)		
College graduate	70	(33.2)		
Graduate school	56	(26.5)		
Current or most recent career				
Laborer	7	(3.3)		
Student	33	(15.6)		
Service worker	19	(9.0)		
Operator	6	(2.8)		
Craftsman	2	(0.9)		
Clerical and sales	18	(8.5)		
Manager	17	(8.1)		
Professional	102	(48.3)		
Employment status				
Employed full-time	53	(25.1)		
Employed part-time	34	(16.1)		
Unemployed/Seeking	34	(16.1)		
Retired/Not seeking	77	(36.5)		
Volunteer full-time	2	(9.0)		
Volunteer part-time	10	(4.7)		
Household income			$48,425	($46,455)
Relationship status				
Single	57	(27.0)		
Married/ long-term rel.	126	(59.7)		

Divorced	21 (10.0)	
Widowed	3 (1.4)	
Level of pain intensity		6.2 (1.9)
Age of disability onset		30.3 (12.5)
Years since onset of pain		12.9 (9.8)
Hours/week of physical activity prior to injury		
None	12 (5.7)	
1-2	40 (19.0)	
3-4	81 (38.4)	
5 or more	78 (37.0)	
Body Mass Index (BMI)		
Underweight	2 (0.9)	
Normal weight	64 (30.3)	
Overweight	50 (23.7)	
Obesity	95 (45.0)	

Note: BMI score of 30 and above indicate obesity; 45% of the participants would be considered to be obese

Measures

Demographic and Disability-Related Variables

As indicated in describing the sample, demographic information was collected from participants regarding age, gender, race/ethnicity, height, weight, waist measurement, educational level, occupational history, employment status, household income, and relationship status. They were also asked to provide more information that was specific to their disability, including prior physical activity, time since disability onset, pain intensity, depression, anxiety, and functional independence.

Pain intensity. The *0-10 Numerical Rating Scale* (NRS) was developed by McCaffery and Beebe (1993) to measure pain intensity. Participants were asked to indicate their average pain intensity during the past week on a 10-point rating scale, from 0 (no pain) to 10 (pain as bad as it could be). The 0-10 NRS has been validated across a broad range of pain conditions (Hoffman, Sadosky, Dukes, & Alvir, 2010; Jensen, Smith, Ehde, & Robinsin, 2001; Serlin, Mendoza, Nakamura, Edwards, & Cleeland, 1995; Zelman, Hoffman, Seifeldin, & Dukes, 2003). The 0-10 NRS also demonstrates strong associations with other pain intensity measures, thus supporting validity (Jensen, Turner, & Romano, 1994; Jensen et al., 1999). The discriminant validity of this scale in measuring sensory rather than affective pain has recently been demonstrated in a sample of individuals with chronic musculoskeletal pain (Huber et al., 2007).

Functional disability. The *World Health Organization Disability Assessment Schedule II* (WHO-DAS 2.0 item version) assesses the impact of a health condition or disability in terms of functioning, which is based on the International Classification of Functioning, Disability and Health (WHO, 1998). There are a total of 12 items that cover six domains of common daily life activities: understanding and communicating with the world; moving and getting around; self-

care; getting along with people; life activities; and participation in society. In each item, respondents estimate the impact of their disability (e.g., "How much have you been emotionally affected by your health problems?") during the previous 30 days using a five-point rating scale. Item scores for each question range from 0 (no difficulty) to 4 (extreme difficulty/cannot do), providing a range from 0 (no disability) to 48 (maximum disability) for the total score. The brief 12-item interviewer-administered version of WHO-DAS 2.0 correlates highly with the full 36-item version (Rehm et al., 1999; Sousa et al., 2010). The WHO-DAS 2.0 was developed and field-tested cross-culturally, and was reported to be useful in both clinical settings and in the general population (Bindt et al., 2012; Von Korff et al., 2008).

Depression. The *Patient Health Questionnaire-9* (PHQ-9) was developed by Kroenke, Spitzer, and Williams (2001) and evaluates symptoms of depression. The PHQ-9 is the depression module of the PHQ (Spitzer, Kroenke, & Williams, 1999), which is a self-administered version of the PRIME-MD diagnostic instrument for common mental health disorders. The PHQ-9 has a total of 9 items based on 9 DSM-IV criteria (e.g., "thoughts that you would be better off dead or of hurting yourself in some way"), and each item is rated on a 3-point scale ranging from 0 (not at all) to 3 (nearly every day). The range of possible total scores is 0–27. Summed scores of 0–4 represent a minimal level of depression; 5–9, mild; 10–14, moderate; 15–19, moderately severe; and 20–27, severe. The internal consistency reliability estimate for a PHQ primary care study was .89 and .86 in a PHQ Obstetrics-Gynecology sample (Spitzer et al., 1999). The PHQ-9 also appears to have good construct validity, as it is associated with health-related quality of life, self-reported sick days and clinic visits, and functional difficulty.

Anxiety. The *Generalized Anxiety Disorder-7* (GAD-7) scale was developed by Spitzer, Kroenke, and Williams (2006) in order to assess symptoms of generalized anxiety. The brief

scale has a total of 7 items, which reflect the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) symptom criteria and existing anxiety scales (e.g., "Feeling nervous, anxious or on edge"). Items are rated using a 4-point scale from 0 (not at all) to 3 (nearly every day). The range of possible total scores is 0–21, and cut-off points of 5, 10, and 15 are interpreted as mild, moderate, and severe levels of anxiety, respectively. The internal reliability consistency estimate for GAD-7 was found to be .92, and the test-retest reliability estimate was .83. Comparison of scores derived from the self-report scales with from the clinician-administered versions of the same scales yield similar results (intraclass correlation = .83), supporting validity. Validity was further demonstrated by the associations between GAD-7 and health-related quality of life scores, self-reported disability, clinic visits, and general functioning. There also was adequate convergent validity documented through correlations between GAD-7 and other anxiety scales.

Contextual Factors

Pain catastrophizing. The *Pain Catastrophizing Scale* (PCS) was developed by Sullivan, Bishop and Pivik (1995) to measure the frequency of catastrophic thoughts related to pain. The PCS consists of 13 items describing various thoughts that individuals might experience when they are in pain. Respondents indicate the frequency with which they experience catastrophic thoughts on a five-point rating scale, ranging from 0 (not at all) to 4 (all the time). Although the original version of this scale yields three different subscales (rumination, magnification, and helplessness), for this study a total summary score was used, with higher scores indicating higher frequency of catastrophic thoughts. The range of possible scores is 0–52. The internal consistency reliability estimate for PCS was found to be .87, and it has been found to be significantly associated with heightened pain, disability, as well as employment status

(Sullivan et al., 1995; Sullivan & Stanish, 2003; Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998).

Resilience. The *4-item Perceived Stress Scale* (PSS-4; Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988) was used to assess the degree to which life situations are perceived as stressful in order to measure resilience. Resilience is defined as the cognitive, emotional, and behavioral responses to stressful life events (Johnson et al., 2011). This scale is composed of 4 items that are introduced with "In the last month, how often have you felt…" which is followed by questions, such as "difficulties were piling up so high that you could not overcome them?" Participants respond on a 5-point scale ranging from 0 (never) to 4 (very often). The responses to the 4 items are then summed to create a perceived stress score, with higher scores indicating greater psychological stress. The range of possible scores is 0–16. The internal consistency reliability estimate for this scale was found to be .72, and test-retest reliability over a two-month period was .55 (Cohen et al., 1983). The PSS-4 is associated with other life-event scales providing support for validity.

Pain acceptance. The *Chronic Pain Acceptance Questionnaire-8* (CPAQ-8; McCracken, Vowles, & Eccleston, 2004) is a shortened version of the 20-item CPAQ (Geiser, 1992) and measures acceptance of pain. The CPAQ-8 has a total of 8 items with two subscales: activity engagement (e.g., "I can lead a full life even though I have chronic pain") and pain willingness (e.g., "I avoid putting myself in situations where my pain might increase"). Participants rate items on a scale from 0 (never true) to 6 (always true). For the current study, only the activity engagement scale was utilized and the range of possible scores was 0–26. The CPAQ-8 has been found to show internal consistency reliability estimates ranging from .77 to .89, and the CPAQ-8 scores are strongly correlated with CPAQ scores, which have demonstrated good internal

consistency (between .78 and .82), factor stability, and construct validity (McCracken et al., 2004).

Mindfulness. The *Cognitive and Affective Mindfulness Scale-Revised (*CAMS-R) was developed by Feldman, Hayes, Kumar, Greeson, and Laurenceau (2007) to measure everyday mindfulness in regards to thoughts and feelings. The CAMS-R was adapted from the original 18-item CAMS (Kumar, Feldman, & Hayes, 2008) in order to improve the internal consistency. The CAMS-R is composed of a total of 12 items that include four subscales: attention ("I am easily distracted"), present focus ("I am able to focus on the present moment"), awareness ("I try to notice my thoughts without judging them"), and acceptance ("I am able to accept the thoughts and feelings I have"). The scale items are evaluated on a 4-point rating scale from 1 (rarely/not at all) to 4 (almost always). Ratings on the items are summed (items 2, 6, and 7 are reverse scored), and the range of possible scores is 12–48. Higher scores reflect greater mindfulness. The internal consistency reliability estimate for the CAMS-R has been found to be .76. A study by Feldman and Hayes (2005) also demonstrated that the CAMS-R shows strong intercorrelations (r = .66) with the CAMS in an undergraduate sample. There is also evidence for convergent and discriminant validity with concurrent measures of mindfulness, distress, well-being, emotion-regulation, and problem-solving approaches in three samples of university students (Feldman et al., 2007).

Social support for exercise. The *Friend Support for Exercise Habits Scale/Family Support for Exercise Habits Scale* developed by Sallis et al. (1987) measures perceived social support specific to health-related exercise behaviors. The *Friend Support for Exercise Habits Scale* has 5 items to measure exercise encouragement (e.g., "Gave me encouragement to stick with my exercise program") and the *Family Support for Exercise Habits Scale* has 15 items to

assess family participation and involvement (e.g., “Discussed exercise with me”), as well as rewards and punishments (e.g., “Criticized me or made fun of me for exercising”). For this study, only 5 items from each scale were used and modified to reflect physical activity and exercise. Items were endorsed on a 5-point rating scale 1 (never) to 5 (very often). The range of possible scores is 10–50. Sallis et al. reported that the test-retest reliability was in the acceptable range (*r* = .55 to .79), and the internal consistency reliability estimates were high (.61 to 91).

Self-Determination Theory

Autonomy. The *Behavioral Regulation in Exercise Questionnaire-2* (BREQ-2) was developed by Markland and Tobin (2004) to measure perceived locus of causality (PLOC) for leisure-time physical activity. The BREQ-2 is a revised version of the original BREQ (Mullan, Markland, & Ingledew, 1997), which was based on Ryan and Connell’s (1989) measure of PLOC. The BREQ-2 is comprised of 19 items with five subscales: intrinsic motivation (e.g., “I enjoy exercise”), identified regulation (e.g., “I participate in exercise because I gain a lot of benefits that are important to me”), introjected regulation (e.g., “I will feel bad with myself if I do not exercise”), external regulation (e.g., “I do it because significant others want me to exercise”) and amotivation (e.g., “I don’t see the point in exercising”). The BREQ assesses the reasons why people exercise by using the stem ‘‘Why do you exercise?’’ and participants respond to each item on a 5-point rating scale ranging from 0 (not true for me) to 4 (very true for me). For this study, the intrinsic motivation and identified regulation scales were combined to create an ‘internal motivation scale’ and the introjected and external regulation scales were combined to represent an ‘external motivation scale’. In addition, the questions were slightly modified to capture engagement in physical activity and exercise. Research findings support the BREQ’s multidimensional five-factor structure and the internal consistency of each subscale

(alphas ranged from .73 to .86).

Competence. Competence was assessed using Bandura's key motivational constructs related to the theory of social cognition. These theoretical components include the competency variables of both self-efficacy and outcome expectancies.

The *Exercise Self-Efficacy Scale* was developed by Bandura (1997) and psychometrically evaluated in a sample of Korean adults by Shin, Jang, and Pender (2001). The scale has a total of 18 items with 3 subscales: (1) situational/interpersonal (e.g., "When I have too much to do at home"), (2) competing demands ("After recovering from an illness that caused me to stop exercising"), and (3) internal feelings ("When I am feeling tired"). Participants rate from 0% (cannot do) to 100% (certain can do), how confident they are that they could perform exercise routines regularly (three or more times a week) under various circumstances. In this study, the items are averaged to obtain a mean score. The internal reliability estimate for the scale was reported to be .94, and a factor analysis using principal axis method with Varimax rotation supported a 3-factor solution (Shin et al., 2001).

The *Outcome Expectations for Exercise Scale* (OEE) was developed by Resnick et al. (2000) to measure the outcome expectancies for physical activity and exercise for older adults. The OEE has 9 items that focus on the positive expectations of exercise (e.g., "Exercise improves my endurance in performing my daily activities"). This study modified the items to indicate physical activity and exercise. The OEE uses a 5-point rating scale of 1 (strongly agree) to 5 (strongly disagree), but the rating scale was re-coded for ease of interpretation in the current study. The items are averaged to obtain a mean score. The internal consistency reliability estimate for the OEE scale was .89, and a confirmatory factor analysis in which the model fit the data demonstrated evidence of validity (NFI= .99, RMSEA= .07, x^2/df= 2.8).

Relatedness. The *Health Care Climate Questionnaire* (HCCQ) was constructed by Williams, Virgina, Zachary, Deci, and Ryan (1996) to measure patients' perceptions of their healthcare provider's support for autonomy, in addition to support related to competence and relatedness. This 15-item scale includes items such as, "I feel that the staff has provided me with choices and options." The items are rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree); one item is reverse coded. A patient's HCCQ score is calculated by taking the average of the individual item scores to yield a mean score between 1 and 7. Higher average scores represent a higher level of perceived autonomy support. For this study, the items were modified to integrate the health behavior of physical activity and exercise. The internal consistency reliability estimate for the HCCQ was .95. After its validation during the weight loss study by Williams et al. (1996), several versions of the questionnaire have been used and adapted in trials on nutrition counseling, exercise, smoking cessation, medication adherence, and diabetes care (Schmidt et al., 2011).

Theory of Planned Behavior

Attitudes. Attitudes toward physical activity were assessed using six differential adjective scales, reflecting both instrumental (harmful–beneficial, useless-useful, unimportant-important) and affective (unenjoyable– enjoyable, boring–fun, painful–pleasurable) aspects of attitude (Courneya, Connor, & Rhodes, 2006). The items were preceded with the following stem: "For me, exercising regularly over the next month would be __." Responses were made on scales ranging from 1 (extremely) to 7 (extremely). For example, "For me exercising regularly over the next month would be extremely boring – extremely fun." Consistent with Ajzen's (2006) guidelines, the six items were averaged to obtain a mean attitude score. Similar items have been frequently used in other physical activity studies framed with the TPB (e.g., Latimer

& Martin Ginis, 2005; Rhodes & Courneya, 2003). For this study items were slightly modified in order to reflect physical activity and exercise. The internal consistency reliability estimates were .79 for instrumental attitude and .87 for affective attitudes, and factor analyses using principal components extraction and oblique rotation supported the two-factor solution for attitudes.

Subjective norms. Following recommendations from Ajzen and colleagues (e.g., Ajzen, 2002; Conner & Sparks, 1996), subjective norms were measured by using two components: injunctive norms and descriptive norms (Courneya, Connor, & Rhodes, 2006). Injunctive norm is preceded by the statement ‘‘I think that if I were to exercise regularly over the next month, most people who are important to me would be ____’’ followed by the three semantic differential scales of disapproving–approving, unsupportive–supportive, and discouraging–encouraging. The three descriptive norm items are: (1) I think that over the next month, most people who are important to me will themselves be _____ (inactive–active), (2) I think that over the next month, most people who are important to me will themselves exercise regularly (disagree–agree), and (3) I think that over the next month, the exercise levels of most people who are important to me will be _____ (low–high). Responses are made on scales ranging from 1 (extremely) to 7 (extremely), and the six items are averaged to obtain a mean score. The items were slightly altered to capture physical activity and exercise. The internal consistency reliability estimates were .84 for injunctive norms and .90 for descriptive norms, and factor analyses using principle components extraction and oblique rotation supported the two-factor solution for subjective norms.

Perceived behavioral control. Azjen (2002) suggests that perceived behavioral control (or control beliefs) should be measured with unidimensional items in order to increase internal reliability and reduce the complexity of having two separate components for self-efficacy and

perceived controllability (Courneya, Connor, & Rhodes, 2006). Six PBC items will be preceded with the following stem: "If you were really motivated, ___," and participants will be asked to endorse the following semantic differential scales: uncontrollable–controllable, untrue–true, disagree–agree, difficult-easy, unconfident-confident, uncertain-certain (e.g., "If you were really motivated, how controllable would it be for you to exercise regularly over the next month"). Responses are made on scales ranging from 1 (extremely) to 7 (extremely), and ratings on the six items are averaged to obtain a mean score. For this study, the questions were slightly modified to reflect physical activity and exercise. The internal consistency reliability estimate for the PBC scale was .91, and factor analyses and scree tests supported a one-factor solution for PBC.

Action planning and coping planning. *The Action Planning and Coping Planning Scale for Exercise* (APCPS-Exercise) was developed by Sniehotta, Schwarzer, Scholz, and Schuz (2005) to operationalize the metacognition of action planning and coping planning for exercise. It is composed of 9 items and two subscales: (a) action planning subscale (e.g., "I already have concrete plans for when to exercise") and (b) coping planning (e.g., "I already have concrete plans what to do if something intervenes"). Items are endorsed on a 4-point rating scale of 1 (not at all true) to 4 (exactly true) and averaged to obtain a mean score. For this study, the items were slightly modified to capture physical activity and exercise. Sniehotta et al. (2005) reported that the internal consistency reliability coefficients (Cronbach's alpha) for action planning were .92 and .90 for coping planning. When Sniehotta et al. (2005) studied action planning and coping planning for long-term life style change regarding exercise, they designed four items for action planning with factor loadings of .78, .81, .84, .76, and .79, respectively, and five items for coping planning with loadings of .78, .81, .84, .76, and .79, respectively.

Intentions

Coureneya, Connor, and Rhodes (2006) developed questions to measure behavioral intentions for exercise. The three intention items are: (1) How motivated are you to exercise regularly over the next month (unmotivated-motivated), (2) I strongly intend to do everything I can to exercise regularly over the next month (untrue-true), and (3) How committed are you to exercising regularly over the next month (uncommitted-committed). These questions were slightly altered to reflect physical activity and exercise. Responses were made on scales ranging from 1 (extremely) to 7 (extremely), and the three items are averaged to obtain a mean score. The internal consistency reliability estimate for the original scale was .95.

Outcome Measures

Physical activity behavior. The *Physical Activity Stages of Change Instrument* (PASC) was developed by Nigg et al. (2005) to assess readiness to engage in physical activity. The PASC is composed of four items (e.g., "Do you currently engage in regular physical activity?"), and the items are rated in a dichotomous "yes" or "no" format. The items were slightly modified to capture both physical activity and exercise. A scoring algorithm was provided by Nigg et al. to convert the scores in the four items to represent the degree of engagement in physical activity along a 5-point continuum: 1 (precontemplation [PC]), 2 (contemplation [C]), 3 (preparation [P]), 4 (action [A]), and 5 (maintenance [M]). Individuals with scores of 4 and 5 were considered to be actively engaging in physical activity for the purpose of this study. The current study regarded the stages of physical activity as how much a person engaged in physical activity and exercise. The higher stages, the more the participant engaged in physical activity and exercise.

Health-related quality of life. Health-related quality of life was assessed by using the *MOS Short form Health Survey* (SF-12v2), which was developed by Ware, Kosinski, and Keller

(1996) to measure of health-related quality of life. The SF-12v2 has 12 items and eight subscales: (a) physical functioning (2 items, e.g., "moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf"); (b) role limitations due to physical problems (2 items, e.g., "accomplished less than you would like"); (c) bodily pain (1 item, e.g., "how much did pain interfere with your normal work?"); (d) general health (1 item, e.g., "would you say your health is excellent/very good/good/fair/poor?"); (e) vitality (1 item, e.g., "did you have a lot of energy?"); (f) social functioning (1 item, e.g., "how much of the time has your physical health or emotional problems interfered with your social activities?"); (g) role limitations due to emotional problems (2 items, e.g., "how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems?"); and (h) mental health (2 items, e.g., "have you felt calm and peaceful?"). Items are endorsed on either a 5-point rating scale of 1 (excellent) to 5 (poor) for items 1, 4, 5, 6, 7, 8, 9, 10, 11, and 12; or a 3-point rating scale of 1 (yes, limited a lot) to 3 (no, not limited at all) for items 2 and 3. The 12 items are summed as a physical component summary scale (PCS), a mental component summary scale (MCS), and a total score. The scores were standardized on a general population sample as well (M=50, SD=10). The first 4 subscales have the highest loading on the PCS and the last four subscales have the highest load on the MCS. For the current study, only the PCS was utilized to represent physical health-related quality of life. Ware et al. reported that test-retest reliability over a 2-week interval was estimated at .89 for the SF-12 PCS.

Work participation. The *Impact on Autonomy and Participation Questionnaire* (IPA or IPAQ) was developed based on the preceding version of ICF (i.e., International Classification of Impairments, Disabilities, and Handicaps (ICIDH)-2) to measure perceived community participation of individuals with chronic illness and disability (Cardol, de Haan, van den Bos, De

Jong, & de Groot, 1999; Cardol, de Haan, de Jong, van den Bos, & de Groot, 2001). The IPA includes 31 self-reported items within 5 subscales: autonomy indoors (e.g., "My chances of getting around in my house when I want to are"), family role (e.g., "My chances of contributing to looking after my home the way I want to are"), autonomy outdoors (e.g., "My chances of seeing people as often as I want are"), social relations (e.g., "My chances of having an intimate relationship are"), and work and education (e.g., "My chances of doing the paid work I want to do are"). This study only utilized 6 items from the work and education subscale. A 5-point rating scale is used to assess perceived level of participation 1 (excellent) to 5 (very poor). The range of possible total scores is 6–30. Internal consistency reliability estimate for the work and education subscale ranged from .79 to .90.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) for Windows was used to perform all data analyses. Data were analyzed using descriptive statistics, preliminary screening procedures, and hierarchical regression to test research hypotheses. Descriptive statistics were computed for all independent and dependent variables to examine the shape of the distribution (normal distribution, skewness, kurtosis), central tendency (mean, median, mode), and dispersion (range, variance, standard deviation). Frequencies, percentages, means, and standard deviations were used to summarize demographic characteristics of participants. The data were screened for missing data, outliers, and multicollinearity. Coefficient alphas were calculated to estimate internal consistency of scores on each measure used.

The primary criterion measure in this study is physical activity and exercise, which is measured by the *Physical Activity Stages of Change Instrument* score. Predictor measures involve disability-related variables; contextual factors; self-determination theory; theory of

planned behavior, and behavioral intentions for physical activity and exercise. The disability-related variables include the following: prior physical activity; *0-10 Numerical Rating Scale; Patient Health Questionnaire-9; Generalized Anxiety Disorder-7;* and the *World Health Organization Disability Assessment Schedule II.* The contextual factors include *Pain Catastrophizing Scale; 4-item Perceived Stress Scale; Chronic Pain Acceptance Questionnaire-8; Cognitive and Affective Mindfulness Scale-Revised;* and the *Friend Support for Exercise Habits Scale/Family Support for Exercise Habits Scale.* The self-determination theory measures are: *Behavioral Regulation in Exercise Questionnaire-2; Exercise Self-Efficacy Scale and Outcome Expectations for Exercise Scale;* and the *Health Care Climate Questionnaire.* And finally, the theory of planned behavior measures include *Attitudes* items*; Subjective norms* items; *Perceived Behavioral Control* items*; Action Planning and Coping Planning Scale for Exercise;* as well as the *Intention* items.

Additional secondary analyses evaluated the effects of physical activity and exercise. The first secondary analysis investigated the effect of physical activity and exercise on the relationship between functional disability and work participation as measured by the work and education subscale from the *Impact on Autonomy and Participation Questionnaire*. Another statistical analysis assessed the effect of physical activity and exercise on the relationship between functional disability and physical health-related quality of life as measured by the *MOS Short Form Health Survey*.

An a priori power analysis was conducted for the total R^2 value for a multiple regression analysis with 22 predictor variables, power equal to .80, and an alpha level of .05. G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), a software tool for a statistical power analysis, yielded a sample size of 163 for a medium effect size (f^2 =.15; Cohen, 1988). In the present study, a

medium effect size was expected based on the medium effect sizes observed in exercise and physical activity research related to the SDT model for people with and without chronic illness and disability (e.g., McBride et al., 2010; Russell & Bray, 2010; Williams, McGregor, Zeldman, Freedman, & Deci, 2004).

Hierarchical Regression Analysis

The primary analysis was conducted using hierarchical regression analysis (HRA) in order to measure the incremental variance accounted for by each predictor set. HRA was used to determine the correlation of each predictor set and to determine the unique contribution and predictive ability of each predictor variable to predict the variance in the criterion variable (PA and exercise). The change in R^2 (ΔR^2) was examined as a measure of the contribution of each predictor set. Five blocks that were entered included (1) prior activity level, pain intensity, depression, anxiety, and functional limitations; (2) pain catastrophizing, perceived stress, pain acceptance, mindfulness, and exercise social support; (3) autonomy, competence, and relatednesss; and (4) attitudes, subjective norms, control beliefs, and action/coping planning; and (5) intentions for physical activity and exercise.

This order of blocks was used to facilitate more accurate understanding of the ability of an integrative and extended SDT model to predict physical activity when controlling for the other predictors. Significance tests for the regression coefficients for each predictor variable were assessed at each block and in the final model to assess unique relationships to the primary dependent variable.

Mediation Analysis

Various analytic techniques have been developed for testing mediator hypotheses (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002), but the most

basic methodology involves the application of multiple regression and correlation techniques proposed by Baron and Kenny (1986). This procedure involves three sequential steps:

1. Regress the mediator onto the IV, to show that it is possible that these two variables can be causally linked.
2. Regress the DV onto the IV, to show that a causal relation is possible here as well.
3. Regress the DV simultaneously onto the IV and the mediator, to show that the mediator is significantly related to the DV even when the IV is statistically controlled.

If the regression coefficients for Steps 1 and 2 are significant and the partial regression coefficient for predicting the DV from the mediator is significant in Step 3, then a mediator hypothesis is supported (Baron & Kenny, 1986). Mediators enable researchers to understand "why" or "how" the IV predicts or causes the DV. Despite its simplicity, multiple regression and correlation techniques can accommodate complex mediator hypotheses as well as use its analytic strategies to statistically control for confounding or related variables (Hoyt, Imel, & Chan, 2007). Therefore, the present study selected to use multiple regression in order to test the mediator hypotheses related to the effect of exercise and physical activity on the relationship between functional disability and work participation and the relationship between functional disability and health-related quality of life (Hoyt et al., 2007). Subsequently, both the Sobel test (Sobel, 1982) and the bootstrap test (Shrout & Bolger, 2002) were conducted to assess the significance of the mediation effects.

CHAPTER FOUR

Results

The purpose of the present study was to examine the predictive ability of an integrative and extended self-determination theory (SDT) for physical activity and exercise participation among people with chronic musculoskeletal pain. Hierarchical regression analysis (HRA) was used to determine the amount of variance in physical activity and exercise that could be accounted for by sets of predictors representing disability-related characteristics, contextual factors, self-determination theory constructs, theory of planned behavior items, and intentions for exercise/physical activity. Based on the results of the primary HRA analysis, a follow-up regression analysis was conducted to identify integrative and extended SDT predictors of intentions for physical activity and exercise. In addition, two mediation analyses were conducted to evaluate the effect of physical activity and exercise on the relationship between functional disability and health-related quality of life and the relationship between functional disability and work participation. This chapter summarizes the results of the statistical analyses used to examine the primary research questions and the follow-up analysis.

Preliminary Data Screening and Analysis

Data for all predictor and outcome variables were screened using SPSS 20.0 for accuracy, multivariate outliers, and normality. Frequency tables were used to identify cases in which data had been entered in error. The presence of multicollinearity was assessed by examining the variance inflation factors (VIF) and tolerance. None of the VIF values exceeded 10 for any variables in the analyses (range = 1.03 to 3.98), and none of the tolerance values were less than .10 (range = .25 to .97), suggesting that there was no multicollinearity in the data and that no large changes in the coefficients would result from adding or deleting variables from the dataset.

With the use of 22 predictors and $p < .01$ criterion for Mahalanobis distance, seven outliers were deleted from the hierarchical multiple regression analysis, resulting in a sample size of 211. Skewness and kurtosis statistics were used to assess normality and linearity; the assumptions of multivariate analyses were found to be met. An a priori power analysis was conducted for the total R^2 value for a multiple regression analysis with 22 predictor variables, power equal to .80, and an alpha level of .05. G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), a software tool for a statistical power analysis, yielded a sample size of 163 for a medium effect size (f^2 =.15; Cohen, 1988). With 22 predictors in the study, the sample size of 211 was judged to be adequate for regression analysis.

Descriptive Statistics

Participants' prior physical activity was relatively low (M = 2.1, SD = 0.9) (see Table 4.1). Regarding disability-related characteristics, pain intensity (M = 6.2, SD = 1.9), functional disability (M = 1.8, SD = 0.8), depression (M = 1.5, SD = 0.2), and anxiety (M = 1.2, SD = 0.2) were all considered to be at or around moderate levels for the participants. With contextual factors, pain catastrophizing (M = 1.8, SD = 0.1), perceived stress (M = 2.1, SD = 0.5), pain acceptance (M = 3.2, SD = 1.4), mindfulness (M = 2.5, SD = 0.6), and family/friend exercise support (M = 1.8, SD = 0.9) were within low to moderate ranges. The SDT factors were within moderate to high ranges including self-efficacy (M = 76.7, SD = 44.3), outcome expectancies (M = 3.7, SD = 0.9), relatedness (M = 4.5, SD = 1.7), and internal motivation (M = 2.2, SD = 1.1), with the exception of external motivation (M = 1.1, SD = 0.8) and amotivation (M = 1.2, SD = 0.6). In addition, all of the TPB constructs were found to be within moderate to high ranges including attitudes (M = 4.8, SD = 1.3), subjective norms (M = 5.0, SD = 1.9), control beliefs (M = 4.7, SD = 1.5), action/coping planning (M = 2.4, SD = 0.9), and intentions (M = 4.6, SD = 1.7).

Finally, on the primary outcome variable of readiness for physical activity and exercise, on average, the participants were in the preparation stage of change ($M = 3.3$, $SD = 1.4$). With regard to the secondary outcome variables, the participants endorsed a fair to good amount of work participation and a relatively low physical health-related quality of life ($M = 35.9$, $SD = 9.2$) compared with the general population.

Table 4.1
Descriptive Statistics for Study Measures ($N = 211$)

Constructs	Measure	Response Range	Mean Item	*SD*	α[a]
Predictor Variables					
Disability-Related Characteristics					
Prior physical activity	Prior physical activity items	1-5	2.1	(0.9)	N/A
Pain intensity level	*NRS*	0-10	6.2	(1.9)	N/A
Functional disability	*WHO-DAS*	0-5	1.8	(0.8)	.90
Depression	*PHQ-9*	0-3	1.5	(0.2)	.85
Anxiety	*GAD-7*	0-3	1.2	(0.2)	.89
Contextual Factors					
Pain catastrophizing	*PCS*	0-4	1.8	(0.1)	.94
Perceived stress	*PSS-4*	0-4	2.1	(0.5)	.81
Pain acceptance	*CPAQ-8* Activity Engagement scale	0-6	3.2	(1.4)	.85
Mindfulness	*CAMS-R*	0-4	2.5	(0.6)	.83
Family/friend exercise support	*Friend/Family Support for Exercise Habits Scale*	0-4	1.8	(0.9)	.91
SDT Constructs					
Competence					
Self-efficacy	*ESES*	0-100	76.7	(44.3)	.96
Outcome expectancy	*OEE*	1-5	3.7	(0.9)	.96
Relatedness	*HCCQ*	1-7	4.5	(1.7)	.90
Autonomy	*BREQ-2*				
External motivation	External motivation subscales	0-4	1.1	(0.8)	.75

Internal motivation	Internal motivation subscales	0-4	2.2	(1.1)	.93
Amotivation	Amotivation subscale	0-4	1.2	(0.6)	.86
TPB Constructs					
Attitudes	Attitudes TPB scale	1-7	4.8	(1.3)	.88
Subjective norms	Normative Beliefs TPB scale	1-7	5.0	(0.9)	.81
Control beliefs	Control Beliefs TPB scale	1-7	4.7	(1.5)	.93
Action/Coping Planning	*APCPS*-Exercise	1-5	2.4	(0.9)	.95
Intention items					
Intentions for PAE	Intentions for PAE Scale	1-7	4.6	(1.7)	.94
Outcome Variables					
PAE level	*Physical Activity Stages of Change Instrument*	1-5	3.3	(1.4)	N/A
Work participation	*IPAQ* Work Participation scale	1-5	2.6	(1.2)	.93
Health-related quality of life	*MOS Short-form Health Survey*				
Physical health	Physical health component	Varied	35.9	(9.2)	N/A

Note. PAE = Physical Activity and Exercise; NRS = *0-10 Numerical Rating Scale*; WHO-DAS = *World Health Organization Disability Assessment Schedule II*; PHQ-9 = *Patient Health Questionnaire-9* ; GAD-7 = *Generalized Anxiety Disorder-7* ; PCS = Pain Catastrophizing Scale; PSS-4 = *4-item Perceived Stress Scale* ; CPAQ-8 = *Chronic Pain Acceptance Questionnaire-8*; CAMS-R = *Cognitive and Affective Mindfulness Scale-Revised*; FFES = *Friend Support for Exercise Habits Scale/Family Support for Exercise Habits Scale*; HCCQ = *Health Care Climate Questionnaire*; BREQ-2 = *Behavioral Regulation in Exercise Questionnaire-2;* ESES = *Exercise Self-Efficacy Scale;* OEE = *Outcome Expectations for Exercise Scale*; TPB = Theory of Planned Behavior; APCPS-Exercise = *Action Planning and Coping Planning Scale for Exercise;* IPAQ = *Impact on Autonomy and Participation Questionnaire*.
[a]Cronbach's alpha.

Hierarchical Regression Analysis

Hierarchical regression analysis was conducted to answer the primary research question, with physical activity and exercise participation as the dependent variable and five sets of integrative and extended variables entered as predictors in sequential steps: (a) disability-related characteristics (i.e., prior physical activity level, pain intensity, depression, anxiety, functional limitations); (b) contextual factors (i.e., pain catastrophizing, pain acceptance, resilience, mindfulness, exercise support); (c) self-determination theory constructs (i.e., competence, relatedness, and autonomy); (d) theory of planned behavior items (i.e., subjective norms, attitudes, control beliefs, and coping-planning); and (d) intentions for physical activity and exercise. The correlation matrix for all variables is presented in Table 4.1.

The correlations among the dependent variable and the predictor variables ranged from small to large. Pearson product-moment correlation coefficients in the 40s to 60s range were found between functional disability and pain intensity, $r = .44$, $p < .01$; functional disability and depression, $r = .70$, $p < .01$; functional disability and anxiety, $r = .60$, $p < .01$; anxiety and depression, $r = .69$, $p < .01$; functional disability and pain catastrophizing, $r = .64$, $p < .01$; pain catastrophizing and depression, $r = .69$, $p < .01$; pain catastrophizing and anxiety, $r = .62$, $p < .01$; functional disability and perceived stress, $r = .63$, $p < .01$; perceived stress and depression, $r = .66$, $p < .01$; perceived stress and anxiety, $r = .61$, $p < .01$; and perceived stress and pain catastrophizing, $r = .61$, $p < .01$. Functional disability was found to be inversely related to pain acceptance, $r = -.62$, $p < .01$, mindfulness, $r = -.42$, $p < .01$, outcome expectancies, $r = -.40$, $p < .01$; attitudes, $r = -.44$, $p < .01$; and control beliefs, $r = -.48$, $p < .01$. In addition, depression was inversely correlated with attitudes, $r = -.40$, $p < .01$; control beliefs, $r = -.43$, $p < .01$, and

intentions, $r = -.39$, $p < .01$. There was also a negative relationship between pain catastrophizing and control beliefs, $r = -.43$, $p < .01$; and perceived stress and control beliefs, $r = -.48$, $p < .01$.

Moreover, pain acceptance was positively correlated with internal motivation, $r = .39$, $p < .01$; outcome expectancies, $r = .40$, $p < .01$; and attitudes, $r = .47$, $p < .01$; control beliefs, $r = .55$, $p < .01$; action/coping planning, $r = .44$, $p < .01$; intentions, $r = .43$, $p < .01$; and physical activity participation, $r = .43$, $p < .01$. Friend/family exercise support was related to subjective norms, $r = .47$, $p < .01$ and action/coping planning, $r = .42$, $p < .01$; and relatedness was correlated with subjective norms, $r = .41$, $p < .01$. Amotivation was significantly related to external motivation, $r = .55$, $p < .01$; while internal motivation was positively correlated with self-efficacy, $r = .66$, $p < .01$; outcome expectancies, $r = .71$, $p < .01$; attitudes, $r = .75$, $p < .01$; control beliefs, $r = .52$, $p < .01$; coping-planning, $r = .64$, $p < .01$; intentions, $r = .66$, $p < .01$; and physical activity participation, $r = .57$, $p < .01$. Self-efficacy was also significantly related to control beliefs, $r = .46$, $p < .01$, action/coping planning, $r = .67$, $p < .01$; intentions, $r = .65$, $p < .01$; and physical activity and exercise participation, $r = .61$, $p < .01$. In addition, outcome expectancies were significantly correlated with self-efficacy, $r = .55$, $p < .01$; attitudes, $r = .74$, $p < .01$, control beliefs, $r = .54$, $p < .01$, action/coping planning, $r = .53$, $p < .01$; intentions, $r = .55$, $p < .01$; and physical activity and exercise participation, $r = .52$, $p < .01$. Furthermore, attitudes were positive related to control beliefs, $r = .63$, $p < .01$, action/coping planning, $r = .61$, $p < .01$; intentions, $r = .66$, $p < .01$; and physical activity and exercise participation, $r = .53$, $p < .01$. Control beliefs was also significantly related to action/coping planning, $r = .56$, $p < .01$; intentions, $r = .58$, $p < .01$; and physical activity and exercise participation, $r = .56$, $p < .01$, whereas action/coping planning was positively related to intentions, $r = .68$, $p < .01$; and physical activity and exercise participation, $r = .60$, $p < .01$.

HRA was used to examine the relative contributions of the five sets of SDT integrative and extended variables as predictors of physical activity participation in persons with SCI. The results of the analysis, including values of change in R^2 (ΔR^2), along with unstandardized regression coefficients (*B*), standard errors (*SE B*), and standardized coefficients (β) for the predictor variables at each step and in the final model are presented in Table 4.2.

Table 4.2

Correlations, Means, and Standard Deviations for Variables Used in Hierarchical Regression Analyses

Variable	1	2	3	4	5	6	7	8	9	10
1. PAE Participation	--									
2. Prior PAE	.18**	--								
3. NRS	-.11*	.14*	--							
4. WHO-DAS	-.37**	-.05	.44**	--						
5. PHQ-9	-.32**	.01	.34**	.70**	--					
6. GAD-7	-.29**	.02	.26**	.60**	.69**	--				
7. PCS	-.30**	-.00	.40**	.64**	.69**	.62**	--			
8. PSS-4	-.34**	.02	.27**	.63**	.66**	.61**	.61**	--		
9. CPAQ-8	.43**	.05	-.31**	-.62**	-.54**	-.43**	-.55**	-.62**	--	
10. CAMS-R	.32**	.08	-.03	-.42**	-.52**	-.60**	-.44**	-.60**	.51**	--
Mean	3.29	2.07	6.21	21.93	13.80	8.36	23.68	8.55	12.61	30.50
Standard Deviation	1.38	.89	1.87	9.55	6.23	5.53	13.08	3.43	5.48	6.57

(Cont'd)

Correlations, Means, and Standard Deviations for Variables Used in Hierarchical Regression Analyses

Variable	11	12	13	14	15	16	17	18	19	20	21	22
1. PAE Participation	.38**	.23**	-.09	.58**	.08	.61**	.52**	.53**	.26**	.55**	.61**	.68**
2. Prior PAE	.15*	.05	.03	.24**	.10	.21**	.11	.11	.02	.02	.15*	.21**
3. NRS	-.04	-.04	-.12*	-.13	-.19**	-.13*	-.17**	-.21**	-.03**	-.32**	-.13**	-.12*
4. WHO-DAS	-.22**	-.22**	.09	-.34**	-.04	-.36**	-.41**	-.46**	-.23**	-.47**	-.38**	-.36**
5. PHQ-9	-.23**	-.31**	.15*	-.39**	-.03	-.36**	-.38**	-.42**	-.25**	-.45**	-.35**	-.40**
6. GAD-7	-.16*	-.28**	.16*	-.25	.08	-.36**	-.32**	-.32**	-.19**	-.39**	-.29**	-.38**
7. PCS	-.20**	-.29**	.15*	-.32**	-.03	-.33**	-.34**	-.39**	-.22**	-.45**	-.32**	-.39**
8. PSS-4	-.26**	-.24**	.09	-.33**	-.03	-.33**	-.36**	-.36**	-.26**	-.49**	-.33**	-.36**
9. CPAQ-8	.30**	.28**	-.04	.41**	.15	-.39**	.41**	.48**	.31**	.56**	.47**	.45**
10. CAMS-R	.27**	.26**	-.22**	.29**	-.06	.38**	.26**	.27**	.23**	.29**	.34**	.36**
11. FFES	--	.29**	.09	.35**	.08	.31**	.27**	.38**	.47**	.33**	.41**	.37**
12. HCCQ	.29**	--	-.09	.20**	.01	.20**	.22**	.21**	.41**	.25**	.36**	.25**
13. External motivation	.09	-.09	--	.00	.54**	-.13*	.02	-.05	.03	-.07	-.11	-.12*
14. Internal motivation	.35**	.20**	.00	--	.28**	.66**	.71**	.75**	.29**	.52**	.64**	.68**
15. Amotivation	.08	.01	.54**	.28**	--	.02	.17**	.21**	.04	.14*	.09	.07
16. ESES	.31**	.21**	-.13*	.66**	-.36	--	.55**	.53**	.29**	.45**	.67**	.67**
17. OEE	.27**	.22**	.01	.71**	-.38**	-.32**	--	.74**	.26**	.53**	.53**	.57**
18. TPB Attitudes	.38**	.21**	-.05	.75**	-.42**	-.32**	.74**	--	.32**	.63**	.60**	.67**
19. TPB Norm	.47**	.41**	.03	.29**	.04	.29**	.26**	.32**	--	.31**	.32**	.31**
20. TPB control beliefs	.33**	.25**	-.07	.52**	.14*	.45**	.53**	.63**	.31**	--	.56**	.60**
21. APCPS-Exercise	.41**	.36**	-.11	.64**	.09	.67**	.53**	.60**	.32**	.56**	--	.70**
22. Intention	.37**	.25**	-.12*	.68**	.07	.67**	.57**	.67**	.31**	.59**	.70**	--
Mean	17.95	4.47	7.46	17.97	1.19	4.28	3.73	4.8	5.03	4.67	2.37	4.63
Standard Deviation	8.67	1.65	5.49	8.99	.59	2.44	.87	1.27	.94	1.49	.89	1.75

Note. PAE = Physical Activity and Exercise; NRS = *0-10 Numerical Rating Scale*; WHO-DAS = *World Health Organization Disability Assessment Schedule II*; PHQ-9 = *Patient Health Questionnaire-9* ; GAD-7 = *Generalized Anxiety Disorder-7* ; PCS = Pain Catastrophizing Scale; PSS-4 = *4-item Perceived Stress Scale* ; CPAQ-8 = *Chronic Pain Acceptance Questionnaire-8*; CAMS-R = *Cognitive and Affective Mindfulness Scale-Revised*; FFES = *Friend Support for Exercise Habits Scale/Family Support for Exercise Habits Scale*; HCCQ = *Health Care Climate Questionnaire*; ESES = *Exercise Self-Efficacy Scale;* OEE = *Outcome Expectations for Exercise Scale*; TPB = Theory of Planned Behavior; APCPS-Exercise = *Action Planning and Coping Planning Scale for Exercise*.

*$p < .05$

**$p < .01$

Table 4.3

Hierarchical Regression Analysis for Prediction of Physical Activity and Exercise Participation ($N = 211$)

			At Entry Into Model			Final Model		
Variable	R^2	ΔR^2	*B*	*SE B*	β	*B*	*SE B*	β
Step 1	.18	.18**						
Prior Physical Activity			.25	.10	.16 **	.03	.08	.02
Pain Intensity			.03	.05	.04	.03	.04	.04
Disability			-.04	.01	-.28 **	-.02	.01	-.13
Depression			-.02	.02	-.10	.01	.02	.06
Anxiety			-.02	.02	-.07	.02	.02	.07
Step 2	.29	.11**						
Pain Catastrophizing			-.00	.01	-.01	.00	.01	.02
Perceived Stress			-.01	.04	-.02	-.00	.03	-.00
Pain Acceptance			.06	.02	.24 **	.01	.02	.04
Mindfulness			.01	.02	.03	.00	.02	.02
Family/Friend Exercise Support			.04	.01	.24 **	.02	.01	.10
Step 3	.48	.19**						
Relatedness			.02	.05	.02	.01	.05	.01
Autonomy								
External motivation			-.02	.02	-.06	-.01	.02	-.03
Internal motivation			.02	.02	.15	.01	.02	.04
Amotivation			.00	.16	.00	.03	.15	.01
Competence								
Self-efficacy			.18	.04	.32 **	.11	.04	.20*
Outcome expectancies			.20	.13	.13	.17	.13	.10
Step 4	.52	.04**						
Attitudes			-.05	.10	-.05	-.13	.10	-.12
Subjective norms			-.06	.09	-.04	-.07	.09	-.04
Control beliefs			.22	.07	.24 **	.18	.07	.19*

Action/Coping planning			.22	.13	.15	.07	.13	.05
Step 5	.56	.04**						
Intentions			.28	.06	.36**	.28	.06	.36**

Note. F (21, 189) = 11.62, $p < .001$ for the full model; F (5, 205) = 8.79, $p < .001$, for Step 1; $\Delta F(5, 200) = 6.07$, $p < .001$ for Step 2; $\Delta F(6, 194) = 11.87$, $p < .001$ for Step 3; $\Delta F(4, 190) = 4.19$, $p < .01$ for Step 4; $\Delta F(1, 189) = 19.11$, $p < .001$ for Step 5.
*$p < .05$, **$p < .01$

In the first step of the regression analysis, disability-related characteristics (prior physical activity level, pain intensity, depression, anxiety, functional limitations) were entered. This set of variables accounted for a significant amount of variance in physical activity and exercise participation scores, $R = .42$, $R^2 = .18$, $F\ (5, 205) = 8.79$, $p < .001$. Examining the standardized partial regression coefficients, prior physical activity was found to significantly contribute to the change in variance in physical activity and exercise participation scores, with $\beta = .16$, $t\ (209) = 2.53$, $p < 0.05$. This result indicates that prior physical activity level was positively associated with physical activity and exercise participation after disability onset and each standard deviation unit change on pre-injury physical activity was predicted to correspond to a .17 standard deviation unit change on physical activity (holding other disability-related characteristics constant). Functional disability also contributed significantly to the change in variance in physical activity and exercise participation scores, with $\beta = -.28$, $t\ (209) = -2.88$, $p < 0.01$. However, this relationship between severity and activity was negative, indicating that higher level of functional limitations was associated with a lower level of post-injury physical activity and exercise participation.

Contextual factors (pain catastrophizing, pain acceptance, resilience, mindfulness, friend/family exercise support) were entered in the second step of the regression analysis. The addition of these variables did account for a significant increase in variance of physical activity and exercise participation beyond that explained by the previous set of predictors, $R = .53$, $R^2 = .29$, $\Delta R^2 = .11$, $F\ (5, 200) = 6.07$, $p < .001$. Examining the additional standardized partial regression coefficients, pain acceptance was found to significantly contribute to the change in variance in physical activity and exercise participation scores, with $\beta = .24$, $t\ (209) = 2.70$, $p < .01$. Friend/family exercise support was also found to significantly contribute, with $\beta = .24$, t

(209) = 3.68, $p < .001$. The other contextual factors did not significantly contribute to the variance in physical activity and exercise.

The self-determination theory constructs (i.e., competence [self-efficacy, outcome expectancy], relatedness, and autonomy [internal motivation, external motivation, and amotivation]) were entered in the third step of the regression analysis. These variables also accounted for a significant amount of additional variance in physical activity and exercise participation scores beyond that explained by the previous predictor sets, $R = .69$, $R^2 = .48$, $\Delta R^2 = .19$, F (6,194) = 11.87, $p < .001$. Self-efficacy for physical activity and exercise was found to contribute significantly to the change in variance in physical activity and exercise participation scores, with $\beta = .32$, t (209) = 4.26, $p < .001$, indicating that increased self-efficacy for physical activity and exercise was associated with greater physical activity and exercise participation. However, outcome expectancy was not found to be a significant contributor to the change in variance in physical activity and exercise participation scores, with $\beta = .13$, t (209) = 1.56, $p = .11$. Relatedness was also not found to be a significant contributor to the change in variance in physical activity and exercise participation scores, with $\beta = .02$, t (209) = 0.40, $p = .68$. In addition, autonomy was not found to be a significant contributor to the change in variance in physical activity and exercise participation scores, with $\beta = -.06$, t (209) = -.92, $p = .36$; $\beta = .15$, t (209) = 1.62, $p = .11$; and $\beta = .00$, t (209) = .00, $p = .10$ for external motivation, internal motivation, and amotivation, respectively.

For the fourth block of variables, the theory of planned behavior items (subjective norms, attitudes, control beliefs, and coping-planning) were entered into the regression analysis. These new variables accounted for a significant amount of additional variance in physical activity participation scores beyond that explained by the other three variable sets entered in previous

steps, $R = .72$, $R^2 = .52$, $\Delta R^2 = .04$, $F\ (4, 190) = 4.19$, $p < .001$. Control beliefs was found to contribute significantly to the change in variance in physical activity and exercise participation scores, with $\beta = .24$, $t\ (209) = 3.20$, $p < .01$, indicating that increased control beliefs was associated with greater physical activity and exercise participation. The remaining theory of planned behavior variables were not found to make significant contributions.

Lastly, the variable of intentions for physical activity and exercise was entered for the final step. The addition of this variable accounted for a significant amount of further variance in physical activity participation scores beyond that explained by the variables entered in previous steps, $R = .75$, $R^2 = .56$, $\Delta R^2 = .04$, $F\ (1, 189) = 19.11$, $p < .001$. More specifically, intentions for physical activity and exercise was found to contribute significantly to the change in variance in physical activity and exercise participation scores, with $\beta = .28$, $t\ (209) = 4.37$, $p < .001$, indicating that additional intentions for physical activity and exercise was associated with greater physical activity and exercise participation. Exercise self-efficacy remained a significant contributor to the variance in physical activity and exercise participation in the final step, $\beta = .20$, $t(209) = 2.54$, $p < .05$. Control beliefs also remained a significant predictor of physical activity and exercise participation, $\beta = .19$, $t(209) = 2.60$, $p < .05$. The final regression model accounted for 56% of the variance in physical activity and exercise participation. According to Cohen's standards for the behavioral sciences, this is considered a large effect size (Cohen, 1988; 1992). Controlling for all other factors, self-efficacy, control beliefs, and intentions for physical activity and exercise were found to be the only significant predictors of physical activity and exercise participation in persons with chronic musculoskeletal pain. Intentions for physical activity and exercise was the strongest predictor in the final model and its effect, $r = .28$, $\beta = .34$, on physical activity and exercise participation was not mediated by the rest of the variables in the model.

Since intentions for physical activity and exercise can be considered a health outcome in an integrative and extended SDT model, a follow-up analysis was conducted to determine whether disability-related characteristics, contextual factors, self-determination theory constructs, and theory of planned behavior items predict intentions for physical activity and exercise. This secondary analysis can provide useful information on motivating people with chronic musculoskeletal pain to form intentions for physical activity and exercise participation. The HRA results of this secondary analysis are presented in Table 4.3.

In the first step of this hierarchical regression analysis with intention for physical activity and exercise as the criterion variable, prior physical activity level, pain intensity, depression, anxiety, and functional limitations were entered as disability-related covariates. This set of variables accounted for a significant amount of variance in intention scores, $R = .47$, $R^2 = .22$, $F(5, 205) = 11.63$, $p < .001$. Examining the standardized partial regression coefficients, prior physical activity was found to significantly contribute to the change in variance in physical activity and exercise participation scores, with $\beta = .20$, $t(209) = 3.17$, $p < 0.01$. In addition, both depression and anxiety were found to significantly contribute to the change in variance in physical activity and exercise participation scores, with $\beta = -.21$, $t(209) = -2.16$, $p < 0.05$; and $\beta = -.19$, $t(209) = -2.11$, $p < 0.05$, respectively. This result indicates that increases in symptoms of depression and anxiety are associated with reduced intentions for physical activity and exercise participation. The other disability-related variables did not significantly contribute to the variance in physical activity and exercise.

The contextual factors of pain catastrophizing, pain acceptance, resilience, mindfulness, and exercise support were entered in the second step of the regression analysis. These variables accounted for an increase in the variance of commitment after controlling for the effects of

disability-related characteristics, $R = .57$, $R^2 = .32$, $\Delta R^2 = .10$, F (5, 200) = 5.94, $p < .001$. Pain acceptance was found to contribute significantly to the change in variance in intention scores, with $\beta = .24$, t (209) = 2.82, $p < .01$, indicating that more pain acceptance was associated with higher levels of intentions. Friend/family support for physical activity and exercise was also found to contribute significantly to the change in variance in intention scores, with $\beta = .22$, t (209) = 3.53, $p < .01$, indicating that increased friend/family support was associated with additional intentions for physical activity and exercise. The other contextual factors did not significantly contribute to the variance in physical activity and exercise.

The self-determination theory constructs of competence (i.e., self-efficacy, outcome expectancy), relatedness, and autonomy (i.e., internal motivation, external motivation, and amotivation) were entered in the third step of the regression analysis. This set of variables accounted for a significant amount of variance in physical activity and exercise participation scores, after controlling for the effect of disability-related characteristics and contextual factors, $R = .76$, $R^2 = .58$, $\Delta R^2 = .25$, F(6, 194) = 19.40, $p < .001$. An examination of the standardized partial regression coefficients revealed that internal motivation augmented intentions for physical activity and exercise, $\beta = .34$, t (209) = 4.03, $p < .001$. Similarly, self-efficacy contributed significantly to explaining variance in intentions, $\beta = .27$, t (209) = 3.99, $p < .001$, indicating that increased self-efficacy for physical activity was associated with greater intentions for physical activity and exercise. The other self-determination variables did not contribute to the overall variance over and above the other variables entered into the analysis.

The theory of planned behavior variables (subjective norms, attitudes, control beliefs, and action/coping planning) were added in the final step of the regression analysis. After controlling for the disability-related characteristics, contextual factors, and self-determination theory

variables, the theory of planned behavior variables did account for an increase in the variance of intention scores, $R = .81$, $R^2 = .65$, $\Delta R^2 = .07$, $F\ (4, 190) = 10.04$, $p < .001$. The final regression model accounted for 65% of the variance in intentions for physical activity and exercise and is considered a large effect size (Cohen, 1988; 1992). Controlling for all other factors, perceived self-efficacy for physical activity and exercise ($\beta = .17$), attitudes ($\beta = .21$), control beliefs ($\beta = .15$), and action/coping planning ($\beta = .28$) were found to be the only significant predictors for intentions for physical activity and exercise in persons with chronic musculoskeletal pain. Action/coping planning for physical activity and exercise was the strongest predictor in the final model and its effect, $r = .28$, $\beta = .28$, on intentions for physical activity and exercise participation was not mediated by the rest of the variables in the model.

Table 4.4

Hierarchical Regression Analysis for Prediction of Intentions for Physical Activity and Exercise Participation ($N = 211$)

			At Entry Into Model			Final Model		
Variable	R^2	ΔR^2	*B*	*SE B*	β	*B*	*SE B*	β
Step 1	.22	.22**						
Prior Physical Activity			.39	.12	.20**	.17	.09	.09
Pain Intensity			.02	.07	.03	.06	.05	.06
Disability			-.02	.02	-.09	.03	.01	.15
Depression			-.06	.03	-.21*	-.02	.02	-.10
Anxiety			-.06	.03	-.19*	-.03	.02	-.10
Step 2	.32	.10**						
Pain Catastrophizing			-.01	.01	-.11	-.01	.01	-.11
Perceived Stress			.01	.05	.03	.02	.04	.03
Pain Acceptance			.08	.03	.24**	.01	.02	.03
Mindfulness			-.00	.02	-.01	-.01	.02	.01
Exercise Support			.04	.01	.22**	.00	.01	.02
Step 3	.58	.25**						
Relatedness			.01	.05	.01	-.05	.05	-.05
Autonomy								
External motivation			-.02	.02	-.06	.00	.02	.00
Internal motivation			.07	.02	.34**	.03	.02	.14
Amotivation			-.15	.18	-.05	-.21	.17	-.07
Competence								
Self-efficacy			.19	.05	.27**	.12	.05	.17*
Outcome expectancies			.16	.14	.08	-.05	.14	-.02
Step 4	.65	.07**						
Attitudes			.28	.11	.21 **	.28	.11	.21**
Subjective norms			.04	.10	.02	.04	.10	.02
Control beliefs			.17	.08	.15 *	.17	.08	.15*
Action/Coping planning			.53	.14	.28 **	.53	.14	.28**

Note. F (20, 190) = 17.64, $p < .001$ for the full model; F (5, 205) = 11.63, $p < .001$, for Step 1; $\Delta F(5, 200) = 5.94$, $p < .001$ for Step 2;
$\Delta F(6, 194) = 19.40$, $p < .001$ for Step 3; $\Delta F(4, 190) = 10.04$, $p < .001$ for Step 4.
$^{*}p < .05$, $^{**}p < .01$

Mediation Analyses

For the additional statistical analyses, physical activity and exercise was hypothesized to be a mediator between functional disability and physical health-related quality of life, as well as a mediator between functional disability and work participation. Baron and Kenny's (1986) application of multiple regression was used to test this hypothesis, and the results of the mediation analyses are presented in Table 4.4 and Table 4.5. Guidelines provided by Frazier and colleagues (2004), Kenny and colleagues (1998) and Preacher and Hayes (2004) were followed in conducting the mediation analysis.

The first step was to establish a significant relation between the predictor and outcome variables by regressing physical health-related quality of life on functional disability. Functional disability was found to be significantly associated with physical health-related quality of life, β = -.73, t (209) = -15.38, $p < .001$, satisfying the first condition. In the second step, physical activity and exercise (mediator) was regressed on functional disability (predictor). This relationship was found to be significant, β = -.37, t (209) = -5.81, $p < .001$. Finally, physical health-related quality of life (outcome) was simultaneously regressed on severity of SCI (predictor) and physical activity and exercise (mediator). In testing the third condition, the relationship between physical activity and exercise and physical health-related quality of

Table 4.5

Steps in Testing Physical Activity and Exercise as a Mediator between Functional Disability and Physical Health-Related Quality of Life

Conditions for Mediator Model	*B*	*SE B*	B
Condition 1			
Outcome: Physical Health QOL			
Predictor: Functional Disability	-.70	.05	-.73**
Condition 2			
Mediator: Physical Activity			
Predictor: Functional Disability	-.05	.01	-.37**
Condition 3			
Outcome: Physical Health QOL			
Mediator: Physical Activity	1.06	.33	.16**
Predictor: Functional Disability	-.65	.05	-.67**

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

Table 4.6

Steps in Testing Physical Activity and Exercise as a Mediator between Functional Disability and Work Participation

Conditions for Mediator Model	*B*	*SE B*	B
Condition 1			
Outcome: Work Participation			
Predictor: Functional Disability	-.07	.01	-.57**
Condition 2			
Mediator: Physical Activity			
Predictor: Functional Disability	-.05	.01	-.37**
Condition 3			
Outcome: Work Participation			
Mediator: Physical Activity	.12	.05	.14*
Predictor: Functional Disability	-.06	.01	-.52**

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

life, while controlling for the effect of functional disability, was found to be significant, β = -.67, t (209) = 13.39, p < .001, satisfying the final condition for mediation. The regression equation also provided information about the strength of the association between functional disability and physical health-related quality of life, β = .16, t (209) = 3.19, p < .01, while controlling for the effect of physical activity and exercise. The results showed the presence of partial mediation, as the relationship between functional disability and physical health-related quality of life was weakened, from β = -.73 to β = -.67.

To determine the significance of the indirect effect in this partially-mediated model, the modified version of the Sobel (1982) test by Baron and Kenny (1986), which includes an additional denominator term to calculate z-values, was used to create 95% confidence intervals around the estimate of the indirect effect. Results indicated the presence of mediation, z = -2.66, p < .01. Across bootstrapped samples, the mean indirect effect from functional disability, through physical activity and exercise, to physical health quality of life was -.05, $CI_{.99}$ = -.12, -0.01, indicating that the indirect effect was significantly different from zero, p < .01, and supporting the hypothesis that physical activity mediates the negative relationship between functional disability and physical health-related quality of life.

A second mediation analysis was computed to examine the role of physical activity and exercise as a mediator between functional disability and work participation. The first step was to establish a significant relation between the predictor and outcome variables by regressing work participation on functional disability. Functional disability was found to be significantly associated with work participation, β = -.57, t (209) = -10.03, p < .001, satisfying the first condition. In the second step, physical activity and exercise (mediator) was regressed on functional disability (predictor). This relationship was found to be significant, β = -.37, t (209) =

-5.81, $p < .001$. Finally, work participation (outcome) was simultaneously regressed on functional disability (predictor) and physical activity (mediator). In testing the third condition, the relationship between physical activity and work participation, while controlling for the effect of severity of SCI, was found to be significant, $\beta = -.52$, t (209) = -8.55, $p < .001$, satisfying the final condition for mediation. The regression equation also provided information about the weakness of the association between functional disability and work participation, $\beta = .14$, t(209) = 2.29, $p < .01$, while controlling for the effect of physical activity and exercise. The results showed the presence of partial mediation, the relationship between functional disability and work participation was weakened, from $\beta = -.57$ to $\beta = -.52$.

The Sobel (1982) test results indicated the presence of mediation, z = -2.11, $p < .05$. Across bootstrapped samples, the mean indirect effect from functional disability, through physical activity and exercise, to work participation was -0.01, $CI_{.95}$ = -0 .012, -0.001 indicating that the indirect effect was significantly different from zero, $p < .05$, and supporting the hypothesis that physical activity and exercise mediates the relationship between functional disability and work participation.

CHAPTER FIVE

Summary, Discussion, and Implications

According to the Institute of Medicine (2011), over 100 million Americans live with a chronic pain disorder, which is often an unrelenting and serious physical disability influenced by biological, psychological, and social factors (Ehde, Dillworth, & Turner, 2014). Because of comprehensive rehabilitation and healthcare needs, as well as lost work productivity associated with chronic pain, it is a remarkably expensive disability for the individual and the larger society (Jensen & Turk, 2014). The significant public health concern and related economic costs provoke a moral imperative to address the far-reaching effects of chronic pain (IOM, 2011). Given the severity of the problem and the marginal benefits from conventional pharmacological, medical, and surgical treatments, there has been growing attention given to the psychosocial factors within behavior change theories to aid in the design of evidence-based and cost-effective health promotion interventions for individuals with chronic pain (Jensen & Turk, 2014; Turk, Wilson, & Cahana, 2011).

Because of the plethora of research exemplifying the health benefits of regular physical activity and exercise in persons with chronic musculoskeletal pain, a key aim in the health behavioral sciences is to understand the mechanisms behind motivation to participate in the health-promoting behavior of physical activity and exercise (Godin & Kok, 1996). The primary goal of this study was to use an integrative and extended SDT model to identify the key social-cognitive, motivational, and behavioral antecedents of physical activity and exercise so these findings can be used as a basis for effective rehabilitation counseling strategies to promote a more healthy and functional lifestyle (Hagger & Armitage, 2004). More specifically, the current study investigated the relationships among the variables in the different components of the

integrative and extended SDT model (i.e., disability-related characteristics; contextual factors; SDT constructs; TPB items; and intentions for physical activity and exercise) was examined as they apply to people with chronic musculoskeletal pain and their engagement in physical activity and exercise. A secondary objective of this study was to investigate the possible mediating role of physical activity and exercise on two relationships: (1) functional disability and physical health-related quality of life, and (2) functional disability and work participation.

Based on the primary findings, an additional hierarchal regression analysis was conducted in order to evaluate the ability of the integrative and extended SDT to predict intentions for physical activity and exercise as the outcome variable. A summary of the study findings is presented in the next section and will be followed by a general discussion, limitations of this study, clinical implications, and implications for future research.

Summary of Study Findings

The preliminary analyses provided statistical evidence for the reliability of the measures used in operationalizing the integrative and extended SDT constructs. The internal consistency estimates obtained yielded high alpha coefficients for each measure of the predictor variables, with the range of .75 to .96, demonstrating support for the internal consistency reliability of scores. Notably, all of the alpha coefficients were .81 or higher with the exception of the external motivation subscale for the BREQ-2 (.75) at the lowest end of the range. Internal consistency could not be computed for the measurement instruments of prior physical activity, NRS, PASC, and SF-12, because they are not standard rating instruments and test-retest reliability estimates are more appropriate for these instruments.

A correlational analysis was conducted to examine the relationships between the 22 predictors and one outcome variable from the integrative and extended SDT model. Multiple

significant relationships were found. Various medium positive relationships were observed involving intentions for physical activity and exercise, including pain acceptance, mindfulness, friend/family support for exercise, internal motivation, self-efficacy, outcome expectancies, attitudes, subjective norms, control beliefs, action/coping planning, and physical activity and exercise. Moderate to large relationships were also observed between physical activity and exercise and pain acceptance, mindfulness, relatedness, internal motivation, self-efficacy, outcome expectancies, attitudes, control beliefs, and action/coping planning. This indicates that there may be some redundant aspects of the predictor variables, but not to an extent that the variables appear to involve the identical construct.

There were also several large negative relationships involving functional disability, including those with attitudes, subjective norms, as well as large negative relationships between control beliefs, depression, and perceived stress. These results seem feasible since people with higher functional disability likely have more barriers to physical disability and exercise, resulting in poorer attitudes and normative beliefs toward physical activity and exercise. Moreover, it seems viable that individuals with reduced control beliefs toward physical activity and exercise would have higher rates of depression and perceived stress.

In the primary analyses, the predictor variables of integrative and extended SDT model were separated into five blocks: (1) disability-related characteristics, (2) contextual factors, (3) SDT constructs, (4) TPB items, and (5) intentions for physical activity and exercise), and HRA was used to assess the contribution of each construct. In the first block of the analysis, higher prior physical activity and exercise level was found to predict a higher level of physical activity and exercise participation. Also, higher levels of functional disability predicted lower physical activity and exercise levels. The variables added in the second block were contextual factors.

They did account for a significant change in the variance of the outcome variable of physical activity and exercise participation. Both higher pain acceptance and friend/family support for physical activity and exercise were found to predict a greater level of physical activity and exercise participation.

In the third block of the regression analyses, the SDT constructs of competence, relatedness, and autonomy were found to be related to physical activity and exercise. However, only perceived self-efficacy was found to predict a significant amount of the change in variance in physical activity and exercise participation. The variables added in the third step were TPB factors. They did account for a significant change in the variance of the outcome variable of physical activity and exercise participation. Only control beliefs were found to contribute significantly to the change in the outcome variance, indicating that increased control beliefs were associated with greater physical activity and exercise participation.

For the final block of the regression analysis, intentions for physical activity and exercise were added. Intentions for physical activity and exercise were found to be a particularly important predictor of physical activity and exercise participation. Additionally, in the final regression model, perceived self-efficacy and control beliefs remained as significant predictors of the outcome variable. Overall, the final regression model accounted for 56% of the variance in physical activity and exercise participation, which is deemed a large effect size and provides strong evidence for the use of the integrative and extended SDT model in predicting physical activity and exercise participation for people with chronic musculoskeletal pain.

Intentions for physical activity and exercise was a significant predictor variable in the primary analysis, but it can also be considered a primary outcome variable, as it has been investigated as a volitional outcome in previous SDT-based studies on physical activity and

exercise (e.g., Wilson & Rodgers, 2004). Since behavioral intentions have been shown to be proximately related to physical activity and exercise participation, it is important to know which predictive factors can enhance intentions. Hence, a four-step secondary regression analysis was conducted to see if the other predictor variables of the integrative and extended SDT could be used to predict intentions for physical activity and exercise as an outcome variable.

Prior physical activity and exercise level was found to be significant predictor of intentions for physical activity and exercise in the first step of the analysis. This time, functional disability was not a significant predictor; instead, depression and anxiety were found to significantly influence intentions for physical activity and exercise. This finding indicates that greater symptoms of depression and anxiety are associated with decreased intentions for physical activity and exercise participation. In the second step, contextual factors were added, and again both pain acceptance and friend/family support for physical activity and exercise was found to be a significant predictors of intentions for physical activity and exercise. Integrative and extended SDT constructs were added in the third step, and perceived self-efficacy was found to be the significant predictor again, as well as the autonomy variable of internal motivation. In the fourth and final step of the analysis, TPB factors were added, and perceived self-efficacy, attitudes, control beliefs, and action/coping planning were found to be the significant predictors for intentions for physical activity and exercise. In this final regression model, action/coping planning was the strongest predictor of intentions for physical activity and exercise. Overall, the revised model accounted for 65% of the variance in intentions for physical activity and exercise in persons with chronic musculoskeletal pain.

Lastly, two mediation analyses were conducted to formally test the two hypotheses about the possible mediating effect of physical activity and exercise. First, physical activity and

exercise was hypothesized to partially mediate the relationship between functional disability and physical health-related quality of life. The first mediation analysis provided support for this original hypothesis. Physical activity and exercise did partially mediate the inverse relationship between functional disability and physical health-related quality of life, indicating that engagement in physical activity and exercise improved physical health-related quality of life for people with chronic musculoskeletal pain.

In regard to the second mediation question, physical activity and exercise was hypothesized to partially mediate the relationship between functional disability and work participation. The second mediation analysis provided significant evidence for this hypothesis. Physical activity and exercise partially mediated the relationship between functional disability and work participation, indicating that physical activity and exercise played a role in enhancing work participation. Therefore, physical activity and exercise participation was supported as a health-promoting behavior that can lead to improvements in physical health-related quality of life, as well as work participation for people with chronic musculoskeletal pain.

Discussion

This is the first study to explore the potential applications of an integrative and extended SDT model for physical activity and exercise in a sample of persons with chronic musculoskeletal pain. The primary hierarchical regression analysis, as well as the follow-up analysis which evaluated intentions for physical activity and exercise, both provide strong evidence for the use of an integrative and extended SDT model when developing physical activity and exercise interventions for people with chronic musculoskeletal pain. The model in the primary and secondary analysis accounted for 56% and 65% of the variance in the outcome variables, which are considered large effect sizes. This study confirms that the grouping of

organismic and social-cognitive variables has a large effect on physical activity and exercise, which provides further evidence to suggest that integrated model of SDT may help to enhance the predictive value of health promotion models.

A recent meta-analysis reviewed findings from previous studies that combined SDT with TPB constructs and reported that an integrated health promotion model explained approximately 58% of the variance in physical activity (Hagger & Chatzisarantis, 2009). In another study, 149 middle-aged Canadian women from community-based facilities completed measures on TPB items and SDT motivational constructs. The participants reported on physical activity at baseline, and again at six months. The results of a hierarchical regression analysis indicated that attitudes, subjective norms, and autonomous motivation accounted for only 10% of the variance in intentions to increase physical activity. Moreover, a secondary HRA demonstrated that intentions for physical activity predicted a significant, but modest, change in physical activity behavior over time, explaining 6% of the variance in the outcome variable. Autonomous and controlled motivation did not significantly predict a change in physical activity (Fortier, Kowal, Lemyre, & Orpana, 2009). The Fortier et al. findings suggested that intentions might play a significant role in predicting the maintenance of physical activity behavior. A limitation to the Fortier et al. study is that other SDT predictor variables, such as relatedness or competence, were excluded. The importance of the three main SDT variables was highlighted in a recent meta-analysis in which the SDT constructs of autonomy, competence, and relatedness were found to significantly impact physical health ($\rho = .07$ to $.67$) outcomes (Ng et al., 2012).

In the secondary analysis for the present study, using intentions for physical activity and exercise as the outcome variable, the findings were fairly consistent, albeit larger, than a similar research study that evaluated the relationship between SDT constructs of relatedness, motivation

and exercise behavior intentions in a sample of Canadian adult women (Wilson & Rodgers, 2004). The Wilson and Rodgers study found that the SDT model accounted for 49% of the variance in behavioral intentions for exercise. Both autonomous motivation and controlled motivation were significant contributors to the model variance; however, identified regulation had the most significant influence on exercise intentions.

The current study found autonomous motivation (combination of identified and intrinsic regulation) to be an initial significant predictor for the secondary analysis; but only the constructs of perceived self-efficacy, attitudes, control beliefs, and action/coping planning were found to be significant contributors to prediction in the final regression model. Action/coping planning was found to be the most significant predictor in the secondary HRA; accordingly, it may be more related to intentions for physical activity and exercise, but not actual physical activity behavior. One possible explanation is that individuals must develop an action/coping plan for engaging in physical activities prior to forming concrete goals for physical activity and exercise. In contrast, individuals that have already formed behavioral intentions for exercise may show more signs of readiness for change or active participation in physical activity and exercise. Another research study examined the integrated effects of SDT motivation regulation and TPB variables on behavioral intentions for sports injury rehabilitation (King-Chung Chan & Hagger, 2012). Those findings revealed that autonomous regulation as well as attitudes, subjective norms, and perceived behavioral control significantly predicted sports injury rehabilitation. Overall, the present study findings were consistent with these example studies and other health behavior studies integrating SDT and TPB models.

Other current research studies have solely focused on the impact of SDT constructs on health-promoting behaviors of people with disabilities. For example, a longitudinal study

examined the effects of SDT on the physical activity behaviors of young adults with physical disabilities (Saebu, Sorenson, & Halvari, 2013). The results indicated that both autonomous motivation and self-efficacy significantly predicted increases in physical activity behavior over a 3-week, inpatient physical activity rehabilitation program. Self-determined motivation for physical activity was also evaluated in a study for individuals with schizophrenia (Vancampfort et al., 2013). This study provided evidence for the significant correlations between motivation regulation and physical activity behavior. More specifically, there were significant relationships between physical activity scores and amotivation (r=0.44, p<0.001), external regulation (r=0.27, p< 0.001), and autonomous regulation (r=0.57, p<0.001). Another study investigated the relationships between SDT motivation constructs and three stages of change (precontemplation, contemplation, and action) for individuals with substance abuse disorders (Kennedy & Gregoire, 2009). The study findings demonstrated that individuals with higher levels of internal motivation were more likely to be in the action stage of change for addictions treatment than in the precontemplation stage. Individuals with more internal motivation were also more likely to be in the contemplation stage instead of the precontemplation stage.

The current study provides considerable support for the integrative and extended structure of the SDT. Since the variables of self-efficacy, attitudes, control beliefs, and action/coping planning – derived from self-determination theory (Ryan & Deci, 2000), social-cognitive health theory (Bandura, 1995), the theory of planned behavior (Fishbein & Ajzen, 1975), and the health action process approach (HAPA; Schwarzer, 1992) – significantly enhance intentions for physical activity and exercise, which subsequently predicts physical activity behavior, provides substantial evidence for the integration of these theories in a health promotion model.

A few variables in the SDT were found to not have significant correlations to the outcome variables. Relatedness was one SDT variable that was not found to be a significant predictor in any of the steps of the analyses, and one reason may include that relatedness is very similar to friend/family support for exercise and physical activity, and its effect may have been mediated by friend/family support. Outcome expectancy is another SDT variable that was found to not be a significant predictor, but it may have been overshadowed by internal motivation or attitudes due to its high correlation and similarity to these constructs. There appears to be substantial overlap of variables from different health promotion models, making it sometimes difficult to draw conclusions about the effect of the variables in various studies. For example, in the social cognitive theory (Bandura, 1977), the consistently significant predictors of health behavior include both self-efficacy and outcome expectancies. However, the theoretical component of outcome expectancy incorporated into SDT construct of competence was found to not be a significant predictor in this study. Outcome expectancy is defined by Bandura (2004) as the belief that engaging in a health-promoting behavior will lead to desirable outcomes. Despite the fact that outcome expectancy was not found to be a significant contributor, its definition indicates that this variable is close to the internal motivation or attitudes variables, which were significant predictors in the secondary analysis. There is a need to clarify definitions of the different social-cognitive variables in order to enhance the predictive ability of health behavior theories.

The integrative and extended SDT model incorporates social-cognitive and motivational constructs of earlier health promotion models, but there may be other predictive behavioral variables important to include to better explain the gap between intention and actual health-promoting behaviors, like physical activity and exercise. Studies in health psychology are

beginning to examine the behavioral pattern of habit formation to improve knowledge and understanding of the process of physical activity maintenance (Gardner & Lally, 2013). Behavioral habits are formed through the repetition of prompts within unvarying environments. Through repeated habit performance, immediate behavioral-contextual associations are reinforced, which leads to minimal cognitive effort in the future when encountering similar contextual prompts (Orbell & Verplanken, 2010). Automaticity does not require intention planning, separating the concept of habit formation from reasoned action, since initiating a behavioral intention requires volitional activation (Bargh, 1994). Thereby, intention for physical activity and exercise is described as a reflective determinant of health behavior, while habit formation is considered an impulsive determinant (e.g., Strack & Deutsch, 2004). In addition, exercise or physical activity habits tend to moderate the intention-behavior relationship, with the effect of intentions on behavior diminishing as habit strength improves (de Bruijn & Rhodes, 2011). The current focus on habit formations in physical activity and exercise self-regulation interventions over intentions has been expanding because forming a habit could protect physical activity and exercise from probable losses in motivation over time (Lally, Wardle, & Gardner, 2011; Rothman, Sheeran, & Wood, 2009).

Another component that may be missing from the current multi-dimensional SDT model is goal content. Goal content is described as a person's specific health goals, whereas behavioral regulation refers to the "why" of motivation or a person's rationale for goal formulation (Deci & Ryan, 2000). Therefore, when utilizing a SDT to study health-enhancing behaviors, both the content and the behavioral regulation of health goals might be important considerations (Sebire, Standage, & Vansteenkiste, 2011). For example, Sebire et al. investigated objective physical health behavior using a mediation analysis, and found that intrinsic goal content had a

significant, although indirect, effect on daily physical activity. It also significantly predicted autonomous regulation for physical activity, which then directly and significantly influenced physical activity participation.

There may also be a variable relevant to pain rehabilitation omitted from the current multi-dimensional SDT model. The construct of pain acceptance was used within the current study; however, within the pain rehabilitation literature a broader construct, psychological flexibility, has been described as germane to the pain treatment process. The developers of acceptance and commitment therapy (ACT) have posited, "psychological flexibility is the capacity to continue with or change behavior, guided by one's goals, in a context of interacting cognitive and direct non-cognitive influences" (McCracken & Vowles, 2014, p. 181). Psychological flexibility is further operationalized as a set of subprocesses including acceptance, cognitive defusion, flexible present focus, self-as-observer, and values-based and committed action (Hayes, Strosahl, & Wilson, 1999).

Research studies have provided early support for the processes of psychological flexibility (e.g., McCracken & Eccleston, 2005; Vowles & McCracken, 2008). For instance, ACT trials for chronic pain have found increases in pain acceptance, general psychological acceptance, mindfulness, and values-based action during pain treatment, which significantly correlated with improvements in anxiety, depression, disability at a three-month follow up, regardless of changes in pain (McCracken & Gutiérrez- Martínez, 2011). Another recent study explored the ACT processes of change for chronic pain and found that psychological flexibility significantly mediated the relationship between functional disability and life satisfaction; yet pain intensity, emotional distress, fear avoidance, and self-efficacy did not (Wicksell, Olsson, & Hayes, 2010). These cumulative findings suggest that psychological flexibility and other

acceptance-based therapeutic processes may produce significant improvements in pain rehabilitation outcomes.

Limitations

Several limitations should be considered when interpreting the results of the current study. First, because of the use of an online survey arrangement and a non-random sample through clinic and community networks, as well as chronic pain and fibromyalgia support groups, the generalizability of the study is restricted. Individuals who seek support services may be different from people who are less aware of or uninterested in resources; therefore, individuals who do not seek assistance may be underrepresented. Another limitation to the present study is that the survey items did not inquire about the kinds of support services received in the past. Moreover, the participants who visited the survey website may be more comfortable with technology, more financially stable, and/or more educated. In addition, the majority of the participants in this study were female European Americans, with men and people from racial and ethnic minority backgrounds markedly underrepresented. This is not the typical composition of a sample of individuals with chronic illness and disability; consequently, the present results may have been impacted.

The current study format included self-reported surveys, which may yield results vulnerable to bias and error. For example, people with chronic pain may overstate their intrinsic motivation for exercise and physical activity, but in actuality, they may not enjoy exercise as much as they would like. In addition, individuals with chronic pain disabilities may have experienced functional limitations, such as fatigue or pain, when using a computer to answer a lengthy survey. As a result, using an online survey may have affected participants' ability to accurately respond to survey questions.

There may also be some limitations due to the difficulty in measuring some constructs. The subjective measurement of physical activity and exercise has provided additional challenges for researchers. Washburn et al. (2002) noted that a major issue with investigating exercise and physical activity behavior of people with disabilities is the paucity of effective and efficient measures. The measurement of actual physical activity and exercise levels via a self-report survey should be interpreted with caution, since it may not highly correlate with more objective indicators. Individuals may answer the questions in a socially desirable manner, especially if they are already actively involved in a physical therapy or rehabilitation program. In addition, the 0-10 Numerical Rating Scale (McCaffery & Beebe, 1993) is the most commonly used measurement instrument for pain intensity, but it may be limiting in that it lacks details about a person's day-to-day experiences with pain. Another limitation to the present study is that it did not include measure items on fatigue, sleep problems, medication use, and weight change since disability onset. This study was also composed of many individuals who experienced chronic musculoskeletal pain for a longer period of time, largely excluding persons with a recent onset of a pain disability.

There were notable challenges in evaluating the integrative and extended SDT health promotion model for individuals with chronic musculoskeletal pain. In an effort to limit the number of items in the survey so as not to make it too onerous for participants, brief measures were usually selected that may not assess as many aspects of a construct. As previously mentioned, some of the predictor variables measured were somewhat similar and not as clearly defined. The overlapping variables can create a problem, since they lead to ambiguity within the theoretical constructs being measured. Furthermore, there was a variable that is a part of the SDT construct of autonomy that was not included in the present study. This variable is integrated

regulation for physical activity and exercise. Integrated regulation represents the most autonomous form of behavioral regulation. It occurs when there is a complete internalization of the behavior, which results in assimilated values, beliefs, and goals that are congruent with the behavior (McLachlan, Spray, & Hagger, 2011). Other SDT-based studies of health behaviors and the current study omitted this construct from the full spectrum of behavioral regulations due to measurement issues with psychometric validity and reliability. Nevertheless, this omission of potential data may have restricted the available information on the overall effectiveness of the SDT model. Another problematic SDT construct with this study may have been the healthcare provider support for autonomy, which was used as a proxy for the construct of relatedness. There were not a vast number of participants directly recruited from clinics; hence, this construct may have limited relevance to the present sample.

A final limitation to this study involves the descriptive, correlational research design that used cross-sectional data. Thus, cause-and-effect relationships cannot be clearly established, since the present study did not actively manipulate variables. Using theoretical assumptions as a guide, the aspects of directionality for the hierarchical regression analysis were implemented using the following succession: disability-related characteristics, contextual factors, SDT constructs, TPB items, and behavioral intentions. However, it is possible that assumptions regarding directionality should be re-arranged, as motivational and volitional processes may have an impact on contextual factors.

Clinical Implications

The present study provides evidence for the applicability of the integrative and extended SDT model in predicting the health-promoting behaviors of physical activity and exercise for people with chronic musculoskeletal pain. There were three significant social-cognitive variables

in the current model: perceived self-efficacy, control beliefs, and intentions for physical activity and exercise. All these social-cognitive variables can be modified and improved, and they should be emphasized throughout the stages of physical activity and exercise change process for individuals with chronic musculoskeletal pain. Rehabilitation professionals could target efforts in working with people to help them enhance both self-efficacy and control beliefs, which consequently may enhance intentions as well as improve the likelihood of behavior change. Once individuals start to adopt new healthy behaviors or change maladaptive behaviors, treatment providers can help clients to form maintenance plans for physical activity and exercise.

A follow-up analysis was also completed with the outcome variable of intentions for physical activity and exercise in order to better understand the earlier motivational processes of health behavior change. The secondary analysis revealed that behavioral intentions for physical activity and exercise was predicted by self-efficacy, attitudes, control beliefs, and action/coping planning. Therefore, initial rehabilitation counseling interventions should focus on addressing these SDT, SCHT, TPB, and HAPA constructs to increase motivation for physical activity and exercise, which will likely enhance intentions for physical activity and exercise for individuals with chronic pain. A growing body of research literature has revealed the importance of social-cognitive and volitional factors behind the adaptation to chronic pain, which is consistent with the findings of the current study.

This study also provided support for the significant negative associations between pain intensity, functional disability, mental health disorders (i.e., depression and anxiety), and intentions for physical activity and exercise participation. This is similar to findings from numerous past studies, which have demonstrated the significant associations of maladaptive cognitive beliefs with pain intensity and related health problems including depression, anxiety,

and activity limitations (e.g., Gatchel, Peng, Peters, Fuchs, & Turk, 2007). Moreover, this study demonstrated evidence for the significant positive associations between pain acceptance, friend/family support, internal motivation, self-efficacy, attitudes, control beliefs, action/coping planning, and intentions for physical activity and exercise. Consequently, the comprehensive results of the present study provide additional theoretical support for elements of cognitive-behavioral therapy (CBT) modalities. Traditional CBT is the most utilized and evidence-based approach for individuals with chronic musculoskeletal pain conditions (Ehde, Dillworth, & Turner, 2014; Morley, 2011); however, the modern types of CBT are becoming increasingly popular, which include mindfulness-based stress reduction (e.g., Schmidt et al., 2011), motivational interviewing (e.g., Vong, Cheing, Chan, So, & Chan, 2011), and acceptance-based therapies (e.g., McCracken & Vowles, 2014). The goals of CBT approaches for chronic pain include reduction in pain intensity and improved physical functioning through assisting individuals in altering maladaptive thoughts, enhancing pain self-efficacy, and adopting healthy behaviors (Turner & Romano, 2001). Simply put, all CBT approaches underscore the counseling technique of helping pain rehabilitation clients to develop the basic life skills necessary to self-manage pain and other health behaviors (Flor & Turk, 2011). This therapeutic approach is congruent with the self-determination philosophy from the integrative and extended SDT model of this study.

The various concepts in traditional CBT methods that are frequently investigated in studies with persons with chronic pain, such as perceived self-efficacy (McCracken & Vowles, 2014), are considered intuitive and easy to understand. These techniques have received great attention over time (including from the present study), but each frames the problem of chronic pain too narrowly and, most importantly, they are not generating new treatment methods. On the

other hand, modern CBT concepts, like the pain acceptance construct also incorporated in the present study, are not easy to learn without the assistance of a specialized treatment provider (Velasco Furlong, Zautra, Peñacoba Puente, López-López, & Barjola Valero, 2010). These new therapy ingredients not only place emphasis on emotions, as well as thoughts, but also the context in which one thinks and feels about health behavior and are only used when they can promote functional improvement. This additional depth added to new behavior change models may provide a better account for the complexity of pain disabilities. Therefore, a contemporary cognitive-behavioral therapy approach, informed by an evidence-based model such as the SDT, may be particularly helpful for the case of pain disability in which cures have not been identified and the overarching goal includes improving rehabilitation outcomes and overall functioning.

Implications for Future Research

The present study findings provide evidence for the use of integrative and extended SDT as a model for physical activity and exercise for people with chronic musculoskeletal pain. In future research studies, this health promotion model can be applied in the investigation of other health-promoting behaviors for people with chronic musculoskeletal pain. With this future research, investigators should aim to utilize a longitudinal design to better determine the direction, course, and long-lasting effects of the theoretical constructs within health promotion models. Another consideration would be to implement qualitative research to directly involve participants, families, and other important others in health promotion studies. With all future studies involving people with chronic pain, investigators should aim to recruit a higher percentage of male participants, minorities, and individuals with less education and limited resources in order to better evaluate any gender or cultural differences affecting motivation for healthy behavior. In addition, the integrative and extended SDT can be explored as a predictive

model for physical activity and exercise or other health-promoting behaviors for different disability groups, such as people with other physical disabilities, substance abuse disorders, or mental illnesses.

Future studies that investigate the effectiveness of SDT should closely examine the differences between forms of motivation for physical activity and exercise. Although the SDT contends that intrinsic regulation promotes the most positive motivational consequences, Ryan (1995) asserts, **"**The lion**'**s share of social development concerns the assimilation of culturally transmitted behavioral regulations and valuations that are neither spontaneous nor inherently satisfying**"** (p. 405) (Ryan & Deci, 2000). Therefore, many individuals may engage in health behaviors not because they are organically pleasant, but because they feel the activity is important for them (Koestner, Losier, Vallerand, & Carducci, 1996). Accordingly, it appears that the types of behavioral regulation for exercise and physical activity merit further inquiry, particularly when engagement in the exercise behavior itself fails to stimulate high levels of intrinsic motivation.

Future SDT-based studies may also want to consider incorporating the construct of perceived exercise support from family/friends as proxy for the construct of relatedness, given the significant results of this construct within this study and others. Prior research suggests that family/friend support for exercise, in particular a desire to be with friends, significantly affects participation (Ryan, Frederick, Lepes, Rubio & Sheldon, 1997). Additionally, empirical studies that investigate the value of friendships in promoting physical activity and exercise participation may help to provide further clarity for the role played by interpersonal relationships in motivational development (Duncan, Duncan, & McAuley, 1993; Vallerand, Fortier, & Guay, 1997).

In past research, the SDT has successfully predicted health-promoting behaviors including smoking cessation, alcohol treatment adherence, and dietary behaviors (Ryan, Plant, & O'Malley, 1995; Williams, Gagne, Ryan, & Deci, 2002; Williams, Grow, Freedman, Ryan, & Deci, 1996). However, the research designs of health promotion studies could be improved to better examine the causal mechanisms and process aspects of motivation. Research methodology should incorporate more applied and rigorous intervention designs, such as randomized controlled trials, to better investigate the reasons why and how individuals adopt and maintain more healthy lifestyles. SDT-based physical activity and exercise interventions for people with chronic musculoskeletal pain disorders can be designed based on current study findings; however, due to the considerable overlap in the health behavior variables, future research should attempt to differentiate between constructs and develop more valid measurement instruments. In addition, researchers should attempt to decrease the incorporation of variables and processes that have already been established (e.g., self-efficacy) and have ceased to be useful concepts for new treatment development (McCracken & Vowles, 2014). Future integrative and extended SDT studies should also add the concepts of habit formation and goal content in an attempt to better explain the variance of physical activity and exercise.

The present study also provided further evidence for CBT processes within an integrative and extended SDT model for individuals with chronic pain. There is a need to study additional CBT methods within the SDT context of health promotion in order to study similarities, differences, and potential for further integration of the two theories. Some CBT interventions, like MI, have started to include SDT measures (e.g., Resnicow, Jackson, & Blissett, 2005; Rubak, Sandbaek, Lauritzen, Borch-Johnsen, & Christensen, 2009). However, there have been mixed results on whether MI interventions facilitate change in autonomous self-regulation

(Fuemmeler et al., 2006). Additional research is also needed to identify which CBT principles operate on perceived relatedness and autonomy. Future research in which both CBT and SDT-based interventions are directly compared may better elucidate the extent to which SDT can explain how and why CBT interventions, like MI, impact health behavior. Previous research has already shown that various CBT approaches result in similar rehabilitation outcomes (e.g., Wetherell et al., 2011); thus, there may be a basic subset of therapeutic mechanisms, such as cognitive content, cognitive processes, and behavioral coping that explain the significant effects of different treatments (Jensen, 2011). These psychological factors may influence each other reciprocally, likely affecting other behavioral change factors (Ehde, Dillworth, & Turner, 2014). Future research studies should also continue to examine the underlying pain treatment mechanisms in order to establish the social-cognitive, motivational, and behavioral processes that may be critical to the development of behavior change theories and eventually, health-promoting strategies.

Conclusion

Over the past century, interdisciplinary research studies have greatly contributed to our knowledge of the complex nature, causes, and consequences of chronic pain, giving rise to the currently prescribed pharmacological and non-pharmacological treatments for individuals with chronic pain (Jensen & Turk, 2014). Although there continues to be a lack of resources available to routinely provide non-pharmacological interventions, there are now several clinically effective and evidence-based cognitive-behavior therapy interventions for rehabilitation and healthcare professionals working with individuals with chronic pain. In particular, there appears to be growing interest in acceptance- and mindfulness-based approaches to pain rehabilitation (McCracken & Vowles, 2014).

While the focus of pain rehabilitation research has redressed both biological and behavioral processes, there is a dearth of studies on health-promoting behaviors for individuals with chronic musculoskeletal pain. Overall, the findings of the present study provide solid support for the utility of an integrative and extended SDT model in predicting both physical activity and exercise participation and behavioral intentions for physical activity and exercise. Moreover, several of the integrative and extended SDT constructs were found to be significant in predicting the outcomes related to physical activity and exercise. This study provides initial support for the validation of this model as a predictor of physical activity and exercise participation for people with chronic musculoskeletal pain. In future research, the integrative and extended SDT model may provide further theoretical guidance on the health-promoting behaviors for individuals with chronic pain.

By uniting the strengths of effective psychosocial theories, we may better understand the needs of individuals with chronic musculoskeletal pain, which may improve the design of new health promotion interventions as well as the general treatment and rehabilitation practices for individuals with chronic pain disabilities.

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Appendix A: IRB Approval Letter

Social and Behavioral Sciences IRB
8/16/2013

Submission ID number:	2013-1020
Title:	Predicting Physical Activity for Individuals with Chronic Musculoskeletal Pain: An Integrated and Extended Self-Determination Theory Perspective
Principal Investigator:	FONG CHAN
Point-of-contact:	FONG CHAN, JESSICA BROOKS
IRB Staff Reviewer:	CASEY PELLIEN

A designated SBS IRB member conducted an expedited review of the above-referenced initial application. The study was approved by the IRB member for the period of 12 months with the expiration date of 8/15/2014. The study qualified for expedited review pursuant to 45 CFR 46.110 and, if applicable, 21 CFR 56.110 and 38 CFR 16.110 in that the study presents no more than minimal risk and involves:

Category 7: Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, or quality assurance methodologies.

To access the materials approved by the IRB, including any stamped consent forms, recruitment materials and the approved protocol, if applicable, please log in to your ARROW account and view the documents tab in the submission's workspace.

If you requested a HIPAA waiver of authorization, altered authorization and/or partial authorization, please log in to your ARROW account and view the history tab in the submission's workspace for approval details.

Prior to starting research activities, please review the Investigator Responsibilities guidance (http://go.wisc.edu/m0lovn.), which includes a description of IRB requirements for submitting continuing review progress reports, changes of protocol and reportable events.

Appendix B: Cover Letter

Instructions for Survey Respondents

Thank you for agreeing to participate in this study. The title of this study is Predicting Physical Activity for Individuals with Chronic Musculoskeletal Pain: An Integrated and Extended Self-Determination Theory Perspective. This research study may help us better understand what motivates people with chronic musculoskeletal pain to engage in physical activity and exercise. We are seeking study participants with the following characteristics:

(1) Diagnosed with chronic musculoskeletal pain
(2) At least 18 years or older
(3) Have pain that is nonmalignant (e.g., lower back pain, bone-related pain, arthritis, fibromyalgia, etc.)
(4) Living with pain for longer than 3 months
(5) Able to engage in some type of physical activity

The survey should take about 45 minutes, but you can save answers and return to it as long as your web browser is open and as your time permits. The survey will ask you questions about you and your health behavior. After completing the survey, you will be rewarded with a $15 gift card for your time and effort.

The survey questions are not considered to be harmful in any way, and it is highly unlikely that responding to this survey will cause any discomfort or distress. We are not requiring identifiable information from you, and any personal, sensitive or directly identifiable information about you, if revealed, will not be included in any publications. When the survey is successfully completed, you will have an opportunity to click on a link and enter your name and address to receive the $15 gift card, but this information is separate from the information you provide in the survey so your answers will remain confidential. Your contact information will be destroyed after gift cards are mailed.

Although there are no direct benefits to you from taking this survey, your participation may contribute to the health promotion knowledge for individuals living with chronic musculoskeletal pain. We hope the health promotion information can be used to develop programs to help people cope with chronic pain through regular physical activity and exercise.

By completing this survey, you are giving your "informed consent," but you can select to skip any questions that you do not wish to answer prior to submitting. You can also choose to quit the survey any time before submitting your responses without penalty and your responses will not be included in our data.

If you have questions about the research you should contact the Principal Investigator, Fong Chan, at chan@education.wisc.edu. You can also contact the student researcher, Jessica Brooks, at brooks1@wisc.edu. If you are not satisfied with the response of the research team, have more questions, or want to talk with someone about your rights as a research participant, you should

contact the Education Research and Social & Behavioral Science Institutional Review Board (IRB) Office at the University of Wisconsin Madison (6082632320; lmlarson@ls.wisc.edu).

Appendix C: Announcement

Health Promotion Online Survey

Over 116 million people live with chronic pain in the United States. One of the frequent causes of pain includes chronic musculoskeletal pain conditions, especially arthritis, lower back pain, and fibromyalgia. Recent studies demonstrate that healthy practices, such as physical activity and exercise, can significantly reduce pain and promote health and well-being.

Researchers at the University of Wisconsin-Madison are investigating what motivates people with chronic pain to engage in physical activity and exercise. We are looking for people diagnosed with **chronic musculoskeletal pain** (e.g., widespread pain) for at least 3 months. Individuals should NOT have cancer-related pain. Additionally, participants should be at least 18 or older and able to engage in some type of physical activity.

Participants can access the **online survey** by going to the following website: https://www.surveymonkey.com/s/THBCZWW. The survey will take about 30-40 minutes to complete (can start and take breaks at any time if web browser stays open). We hope to use this information to develop programs to help people cope with chronic pain through regular physical activity and exercise. After taking the survey, participants will be rewarded with a **$15 gift card.** If you have questions about this study, please contact the Principal Investigator, Dr. Fong Chan, at chan@education.wisc.edu. You can also contact the student researcher, Jessica Brooks, at brooks1@wisc.edu.

Appendix D: Survey Flyer

Health Promotion Survey

Interested in helping study better understand health promoting behavior of individuals with chronic pain?

We are seeking:

(1) Individuals diagnosed with chronic musculoskeletal pain

- **At least 18 years or older**
- **Have pain that is non-malignant (e.g., lower back pain, shoulder-related pain, bone-related pain, arthritis, fibromyalgia, etc.)**
- **Living with pain for longer than 3 months**
- **Able to engage in some type of physical activity**

You can participate in the research study by going to the following website:
https://www.surveymonkey.com/s/THBCZWW

The **online survey** will take you approximately 45 minutes to complete (can start survey and take breaks if web browser stays open). After completing the survey, you will be rewarded with a **$15 gift card** for your time and effort.

We appreciate your support. Your participation may contribute to the health promotion knowledge and practice for individuals living with chronic musculoskeletal pain.

If you have questions about the study, please do not hesitate to contact us.

f you have questions or omments about the study, you an contact the Principal nvestigator, Dr. Fong Chan, at han@education.wisc.edu. You an also contact the student esearcher, Jessica Brooks, at rooks1@wisc.edu.

Appendix E: Survey

Health Promotion Survey

***1. Gender:**

- ◯ Male
- ◯ Female

***2. Age:**

3. Height (feet, inches):

4. Weight (approx. in pounds):

5. Waist measurement (approx. in inches):

6. Marital status:

- ◯ Single
- ◯ Married or in a significant long-term relationship
- ◯ Divorced
- ◯ Widowed

7. Race/Ethnicity you most closely identify with (can choose more than one):

- ☐ African American
- ☐ Asian American
- ☐ Caucasian (White)
- ☐ Latino/Hispanic
- ☐ Native American
- ☐ Other

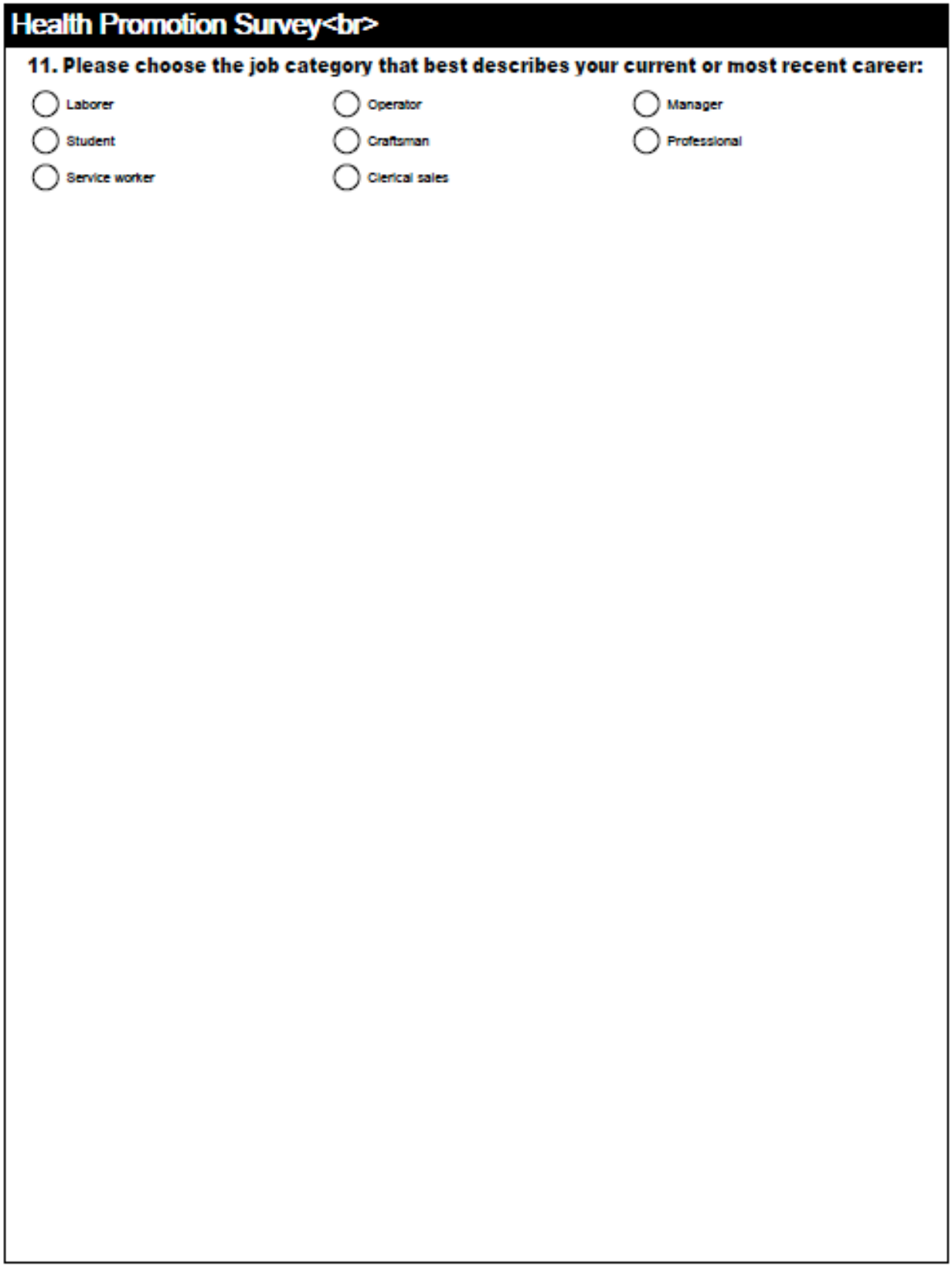
***8. What is your highest level of education?**

- ◯ No formal education
- ◯ Some grade school
- ◯ Grade school graduate
- ◯ Some high school
- ◯ High school graduate
- ◯ Some college
- ◯ College graduate
- ◯ Graduate school

9. Which option(s) best describe(s) your current employment situation?

- ◯ Employed full-time
- ◯ Employed part-time
- ◯ Unemployed, seeking employment
- ◯ Retired or not seeking employment
- ◯ Volunteer, full-time
- ◯ Volunteer, part-time

***10. What is your estimated annual household income in US dollars?**


Health Promotion Survey
11. Please choose the job category that best describes your current or most recent career:
Laborer
Operator
Manager
Student
Craftsman
Professional
Service worker
Clerical sales

***12. Please select the answer that best describes you prior to the onset of your chronic pain condition.**

	0	1-2	3-4	5 or more
Prior to acquiring your chronic pain condition, how many times per week on average did you engage in moderate to vigorous physical activity and exercise (e.g., aerobics, bicycling, swimming, team sports, etc.) for at least 10 minutes at a time that made you breathe much harder than normal?	◯	◯	◯	◯

***13. What was your age at the onset of your chronic pain condition?**

***14. What type of chronic pain condition are you diagnosed with?**

***15. What was the cause(s) of your chronic pain condition?**

***16. How many years has it been since the onset of your chronic pain condition?**

17. Do you have any other secondary health conditions? If yes, please list the other medical conditions.

***18. Please indicate your average pain intensity during the past week on a 10-point rating scale, with 0 (no pain) to 10 (pain as bad as it could be).**

	0 - No pain	1	2	3	4	5	6	7	8	9	10 - Pain as bad as it could be
Pain Intensity	○	○	○	○	○	○	○	○	○	○	○

***19. Over the last two weeks, how often have you been bothered by any of the following problems?**

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

***20. Over the last two weeks, how often have you been bothered by the following problems?**

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge	○	○	○	○
Not being able to stop or control worrying	○	○	○	○
Worrying too much about different things	○	○	○	○
Trouble relaxing	○	○	○	○
Being so restless that it is hard to sit still	○	○	○	○
Becoming easily annoyed or irritable	○	○	○	○
Feeling afraid as if something awful might happen	○	○	○	○

***21. Please indicate how your chronic pain affects your life.**

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

Health Promotion Survey

***22. Think back over the past 30 days and answer these questions, thinking about how much difficulty you had doing the following activities. For each question, please select only one response.**

In the past 30 days, how much difficulty did you have in:

	None	Mild	Moderate	Severe	Extreme or cannot do
Standing for long periods such as 30 minutes?	○	○	○	○	○
Taking care of your household responsibilities?	○	○	○	○	○
Learning a new task, for example, learning how to get to a new place?	○	○	○	○	○
How much of a problem did you have joining in community activities (for example, festivities, religious or other activities) in the same way as anyone else can?	○	○	○	○	○
How much have you been emotionally affected by your health problems?	○	○	○	○	○
Concentrating on doing something for ten minutes?	○	○	○	○	○
Walking a long distance such as a half-mile?	○	○	○	○	○
Washing your whole body?	○	○	○	○	○
Getting dressed?	○	○	○	○	○
Dealing with people you do not know?	○	○	○	○	○
Maintaining a friendship?	○	○	○	○	○
Your day-to-day work?	○	○	○	○	○

***23. Listed below are statements describing different thoughts and feelings that may be associated with pain. Please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.**

When I'm in pain...

	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time
I worry all the time about whether the pain will end	○	○	○	○	○
I feel I can't go on	○	○	○	○	○
It's terrible and I think it's never going to get any better	○	○	○	○	○
It's awful and I feel that it overwhelms me	○	○	○	○	○
I feel I can't stand it anymore	○	○	○	○	○
I become afraid that the pain will get worse	○	○	○	○	○
I keep thinking of other painful events	○	○	○	○	○
I anxiously want the pain to go away	○	○	○	○	○
I can't seem to keep it out of my mind	○	○	○	○	○
I keep thinking about how much it hurts	○	○	○	○	○
I keep thinking about how badly I want the pain to stop	○	○	○	○	○
There's nothing I can do to reduce the intensity of the pain	○	○	○	○	○
I wonder whether something serious may happen	○	○	○	○	○

***24. During the past week, how many days did you use each of these strategies at least once in the day to cope with your pain? Please include days when you use strategies to prevent or minimize pain, even if you did not have pain at that time.**

	0	1	2	3	4	5	6	7
Limited my standing time	○	○	○	○	○	○	○	○
Lay down on a bed	○	○	○	○	○	○	○	○
Asked for help with a chore or task	○	○	○	○	○	○	○	○
Focused on relaxing my muscles	○	○	○	○	○	○	○	○
I didn't let the pain interfere with my activities	○	○	○	○	○	○	○	○
Exercised to improve my overall physical condition for at least 5 minutes	○	○	○	○	○	○	○	○
I got support from a friend	○	○	○	○	○	○	○	○
Told myself the pain will get better	○	○	○	○	○	○	○	○

Health Promotion Survey

***25. The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate HOW OFTEN you felt or thought a certain way.**

	0 - Never	Almost Never	Sometimes	Fairly Often	4 - Very Often
In the last month, how often have you felt that you were unable to control the important things in your life?	◯	◯	◯	◯	◯
In the last month, how often have you felt confident about your ability to handle your personal problems?	◯	◯	◯	◯	◯
In the last month, how often have you felt that things were going your way?	◯	◯	◯	◯	◯
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	◯	◯	◯	◯	◯

***26. Below you will find a list of statements. Please rate the truth of each statement as it applies to you by marking a circle.**

	Never true	Very rarely true	Seldom true	Sometimes true	Often true	Almost always true	Always true
I am getting on with the business of living no matter what my level of pain is	◯	◯	◯	◯	◯	◯	◯
Keeping my pain level under control takes first priority whenever I am doing something	◯	◯	◯	◯	◯	◯	◯
Although things have changed, I am living a normal life despite my chronic pain	◯	◯	◯	◯	◯	◯	◯
Before I can make any serious plans, I have to get some control over my pain	◯	◯	◯	◯	◯	◯	◯
I lead a full life even though I have chronic pain	◯	◯	◯	◯	◯	◯	◯
When my pain increases, I can still take care of my responsibilities	◯	◯	◯	◯	◯	◯	◯
I avoid putting myself in situations where my pain might increase	◯	◯	◯	◯	◯	◯	◯
My worries and fears about what pain will do to me are true	◯	◯	◯	◯	◯	◯	◯

Health Promotion Survey

***27. People have a variety of ways of relating to their thoughts and feelings. For each of the items below, rate how much each of these ways applies to you.**

	Rarely/Not at all	Sometimes	Often	Almost always
It is easy for me to concentrate on what I am doing	◯	◯	◯	◯
I am preoccupied by the future	◯	◯	◯	◯
I can tolerate emotional pain	◯	◯	◯	◯
I can accept things I cannot change	◯	◯	◯	◯
I can usually describe how I feel at the moment in considerable detail	◯	◯	◯	◯
I am easily distracted	◯	◯	◯	◯
I am preoccupied by the past	◯	◯	◯	◯
It's easy for me to keep track of my thoughts and feelings	◯	◯	◯	◯
I try to notice my thoughts without judging them	◯	◯	◯	◯
I am able to accept the thoughts and feelings I have	◯	◯	◯	◯
I am able to focus on the present moment	◯	◯	◯	◯
I am able to pay close attention to one thing for a long period of time	◯	◯	◯	◯

***28. Please rate the frequency with which friends or family members did or said what is described in each item over the last 3 months on a scale from "never" to "very often."**

	1 - Never	2	3	4	5 - Very often
My friend engaged in physical activity and exercise with me	◯	◯	◯	◯	◯
My friend offered to engage in physical activity and exercise with me	◯	◯	◯	◯	◯
My friend gave me helpful reminders to be physically active	◯	◯	◯	◯	◯
My friend gave me encouragement to stick with my physical activity and exercise program	◯	◯	◯	◯	◯
My friend changed their schedule so we could engage in physical activity and exercise together	◯	◯	◯	◯	◯
My family member engaged in physical activity and exercise with me	◯	◯	◯	◯	◯
My family member offered to engage in physical activity and exercise with me	◯	◯	◯	◯	◯
My family member gave me helpful reminders to be physically active	◯	◯	◯	◯	◯
My family member gave me encouragement to stick with my physical activity and exercise program	◯	◯	◯	◯	◯
My family member changed their schedule so we could engage in physical activity and exercise together	◯	◯	◯	◯	◯

***29. There are different reasons underlying peoples' decisions to engage, or not engage in physical activity or exercise. Using the scale below, please indicate to what extent each of the following items is true for you.**

Why do you engage in physical activity and exercise?

	0 - Not true for me	1	2	3	4 - Very true for me
Because other people say I should	◯	◯	◯	◯	◯
I feel guilty when I don't engage in physical activity and exercise	◯	◯	◯	◯	◯
I value the benefits of physical activity and exercise	◯	◯	◯	◯	◯
I engage in physical activity and exercise because it's fun	◯	◯	◯	◯	◯
I don't see why I should have to engage in physical activity and exercise	◯	◯	◯	◯	◯
Because my friends/family/spouse say I should	◯	◯	◯	◯	◯
I feel ashamed when I miss a physical activity and exercise session	◯	◯	◯	◯	◯
It's important to me to engage in physical activity and exercise regularly	◯	◯	◯	◯	◯
I can't see why I should bother engaging in physical activity and exercise	◯	◯	◯	◯	◯
I enjoy my physical activity and exercise sessions	◯	◯	◯	◯	◯
Because others will not be pleased with me if I don't	◯	◯	◯	◯	◯
I feel a failure when I haven't engaged in physical activity and exercise in a while	◯	◯	◯	◯	◯
It's important to make an effort to engage in physical activity and exercise regularly	◯	◯	◯	◯	◯
I don't see the point in engaging in physical activity and exercise	◯	◯	◯	◯	◯
I find physical activity and exercise a pleasurable activity	◯	◯	◯	◯	◯
I feel under pressure from friends/family to engage in physical activity and exercise	◯	◯	◯	◯	◯
I get restless if I don't engage in physical activity and exercise regularly	◯	◯	◯	◯	◯
I think that engaging in physical activity and exercise is a waste of time	◯	◯	◯	◯	◯
I get pleasure and satisfaction from physical activity and exercise	◯	◯	◯	◯	◯

Health Promotion Survey

***30. Using the scales listed below, please indicate how confident you are that you will be able to perform physical activity and exercise regularly (three times or more a week) under various circumstances.**

	Cannot do - 0%	10%	20%	30%	40%	Moderately certain can do - 50%	60%	70%	80%	90%	Certain can do - 100%
When I am feeling tired	○	○	○	○	○	○	○	○	○	○	○
When I am feeling under pressure from work	○	○	○	○	○	○	○	○	○	○	○
During bad weather	○	○	○	○	○	○	○	○	○	○	○
After recovering from an injury that caused me to stop exercising	○	○	○	○	○	○	○	○	○	○	○
During or after experiencing personal problems	○	○	○	○	○	○	○	○	○	○	○
When I am feeling depressed	○	○	○	○	○	○	○	○	○	○	○
When I am feeling anxious	○	○	○	○	○	○	○	○	○	○	○
After recovering from an illness that caused me to stop exercising	○	○	○	○	○	○	○	○	○	○	○
When I feel physical discomfort when I exercise	○	○	○	○	○	○	○	○	○	○	○
After a vacation	○	○	○	○	○	○	○	○	○	○	○
When I have too much work to do at home	○	○	○	○	○	○	○	○	○	○	○
When visitors are present	○	○	○	○	○	○	○	○	○	○	○
When there are other interesting things to do	○	○	○	○	○	○	○	○	○	○	○
If I don't reach my physical activity and exercise goals	○	○	○	○	○	○	○	○	○	○	○
Without support from my family or friends	○	○	○	○	○	○	○	○	○	○	○
During a vacation	○	○	○	○	○	○	○	○	○	○	○
When I have other time commitments	○	○	○	○	○	○	○	○	○	○	○
After experiencing family problems	○	○	○	○	○	○	○	○	○	○	○

Health Promotion Survey

***31. Please rate the following statements regarding your expectations about physical activity and exercise.**

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Physical activity and exercise make me feel better physically	◯	◯	◯	◯	◯
Physical activity and exercise make my mood better in general	◯	◯	◯	◯	◯
Physical activity and exercise help me feel less tired	◯	◯	◯	◯	◯
Physical activity and exercise make my muscles stronger	◯	◯	◯	◯	◯
Physical activity and exercise is an activity I enjoy doing	◯	◯	◯	◯	◯
Physical activity and exercise give me a sense of personal accomplishment	◯	◯	◯	◯	◯
Physical activity and exercise make me more alert mentally	◯	◯	◯	◯	◯
Physical activity and exercise improve my endurance in performing my daily activities	◯	◯	◯	◯	◯
Physical activity and exercise help to strengthen my bones	◯	◯	◯	◯	◯

Health Promotion Survey

***32. The following items are related to your visits with your health care provider. Health care providers have different styles in dealing with chronic pain patients, and we would like to know more about how you have felt about your encounters with your health care provider.**

	1 - Strongly disagree	2	3	4 - Neutral	5	6	7 - Strongly agree
I feel that my health care provider has provided me choices and options for physical activity and exercise	◯	◯	◯	◯	◯	◯	◯
I feel understood by my health care provider	◯	◯	◯	◯	◯	◯	◯
I am able to be open about my physical activity and exercise with my health care provider at our meetings	◯	◯	◯	◯	◯	◯	◯
My health care provider conveys confidence in my ability to make changes in my physical activity and exercise	◯	◯	◯	◯	◯	◯	◯
I feel that my health care provider accepts me	◯	◯	◯	◯	◯	◯	◯
My health care provider has made sure I really understand about my condition and what I need to do with respect to physical activity and exercise	◯	◯	◯	◯	◯	◯	◯
My health care provider encourages me to ask questions about my physical activity and exercise	◯	◯	◯	◯	◯	◯	◯
I feel a lot of trust in my health care provider	◯	◯	◯	◯	◯	◯	◯
My health care provider answers my questions about physical activity and exercise fully and carefully	◯	◯	◯	◯	◯	◯	◯
My health care provider listens to how I would like to do things in regard to physical activity and exercise	◯	◯	◯	◯	◯	◯	◯
My health care provider handles people's emotions very well	◯	◯	◯	◯	◯	◯	◯
I feel that my health care provider cares about me as a person	◯	◯	◯	◯	◯	◯	◯
I don't feel very good about the way my health care provider talks to me with regards to physical activity and exercise	◯	◯	◯	◯	◯	◯	◯
My health care provider tries to understand how I see things with respect to physical activity and exercise before suggesting a new way to do things	◯	◯	◯	◯	◯	◯	◯
I feel able to share my feelings about physical activity and exercise with my health care provider	◯	◯	◯	◯	◯	◯	◯

Health Promotion Survey

***33. Please indicate your feelings toward physical activity and exercise on the below rating scales.**

For me, engaging in physical activity and exercise regularly over the next month would be:

1 - Extremely Harmful	Quite Harmful	Slightly Harmful	Neutral	Slightly Beneficial	Quite Beneficial	7 - Extremely Beneficial
○	○	○	○	○	○	○

***34. For me, engaging in physical activity and exercise regularly over the next month would be:**

1 - Extremely Useless	Quite Useless	Slightly Useless	Neutral	Slightly Useful	Quite Useful	7 - Extremely Useful
○	○	○	○	○	○	○

***35. For me, engaging in physical activity and exercise regularly over the next month would be:**

1 - Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neutral	Slightly Important	Quite Important	7 - Extremely Important
○	○	○	○	○	○	○

***36. For me, engaging in physical activity and exercise regularly over the next month would be:**

1 - Extremely Unenjoyable	Quite Unenjoyable	Slightly Unenjoyable	Neutral	Slightly Enjoyable	Quite Enjoyable	7 - Extremely Enjoyable
○	○	○	○	○	○	○

***37. For me, engaging in physical activity and exercise regularly over the next month would be:**

1 - Extremely Boring	Quite Boring	Slightly Boring	Neutral	Slightly Fun	Quite Fun	7 - Extremely Fun
○	○	○	○	○	○	○

***38. For me, engaging in physical activity and exercise regularly over the next month would be:**

1 - Extremely Painful	Quite Painful	Slightly Painful	Neutral	Slightly Pleasurable	Quite Pleasurable	7 - Extremely Pleasurable
○	○	○	○	○	○	○

***39. I think that if I were to engage in physical activity and exercise regularly over the next month, most people who are important to me would be:**

1 - Extremely Disapproving	Quite Disapproving	Slightly Disapproving	Neutral	Slightly Approving	Quite Approving	7 - Extremely Approving
○	○	○	○	○	○	○

Health Promotion Survey

***40. I think that if I were to engage in physical activity and exercise regularly over the next month, most people who are important to me would be:**

1 - Extremely Unsupportive	Quite Unsupportive	Slightly Unsupportive	Neutral	Slightly Supportive	Quite Supportive	7 - Extremely Supportive
○	○	○	○	○	○	○

***41. I think that if I were to engage in physical activity and exercise regularly over the next month, most people who are important to me would be:**

1 - Extremely Discouraging	Quite Discouraging	Slightly Discouraging	Neutral	Slightly Encouraging	Quite Encouraging	7 - Extremely Encouraging
○	○	○	○	○	○	○

***42. Please indicate your feelings to the following questions by selecting a circle from the 1 to 7 rating scale.**

I think that over the next month, most people who are important to me will themselves be:

1 - Extremely Inactive	Quite Inactive	Slightly Inactive	Neutral	Slightly Active	Quite Active	7 - Extremely Active
○	○	○	○	○	○	○

***43. I think that over the next month, most people who are important to me will themselves engage in physical activity and exercise regularly:**

1 - Extremely Disagree	Quite Disagree	Slightly Disagree	Neutral	Slightly Agree	Quite Agree	7 - Extremely Agree
○	○	○	○	○	○	○

***44. I think that over the next month, the physical activity and exercise levels of most people who are important to me will be:**

1 - Extremely Low	Quite Low	Slightly Low	Neutral	Slightly High	Quite High	7 - Extremely High
○	○	○	○	○	○	○

***45. Please endorse the following 1 to 7 rating scales for each below item.**

If you were really motivated, how controllable would it be for you to engage in physical activity and exercise regularly over the next month:

1 - Extremely Uncontrollable	Quite Uncontrollable	Slightly Uncontrollable	Neutral	Slightly Controllable	Quite Controllable	7 - Extremely Controllable
○	○	○	○	○	○	○

***46. If you were really motivated, do you feel you would have complete control over whether or not you engaged in physical activity and exercise over the next month:**

1 - Extremely Untrue	Quite Untrue	Slightly Untrue	Neutral	Slightly True	Quite True	7 - Extremely True
○	○	○	○	○	○	○

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***47. If you were really motivated, do you feel that whether or not you engaged in physical activity and exercise regularly over the next month would be completely up to you:**

1 - Extremely Disagree	Quite Disagree	Slightly Disagree	Neutral	Slightly Agree	Quite Agree	7 - Extremely Agree
◯	◯	◯	◯	◯	◯	◯

***48. If you were really motivated, how easy or difficult would it be for you to engage in physical activity and exercise regularly over the next month:**

1 - Extremely Difficult	Quite Difficult	Slightly Difficult	Neutral	Slightly Easy	Quite Easy	7 - Extremely Easy
◯	◯	◯	◯	◯	◯	◯

***49. If you were really motivated, how confident are you that you could engage in physical activity and exercise regularly over the next month:**

1 - Extremely Unconfident	Quite Unconfident	Slightly Unconfident	Neutral	Slightly Confident	Quite Confident	7 - Extremely Confident
◯	◯	◯	◯	◯	◯	◯

***50. If you were really motivated, how certain would you be that you could engage in physical activity and exercise regularly over the next month:**

1 - Extremely Uncertain	Quite Uncertain	Slightly Uncertain	Neutral	Slightly Certain	Quite Certain	7 - Extremely Certain
◯	◯	◯	◯	◯	◯	◯

***51. Do you have concrete plans for participating in physical activity and exercise?**

	1 - Not at all true	Barely true	Mostly true	4 - Exactly true
I already have concrete plans when to engage in physical activity and exercise	◯	◯	◯	◯
I already have concrete plans where to engage in physical activity and exercise	◯	◯	◯	◯
I already have concrete plans how to engage in physical activity and exercise	◯	◯	◯	◯
I already have concrete plans how often to engage in physical activity and exercise	◯	◯	◯	◯
I already have concrete plans with whom to engage in physical activity and exercise	◯	◯	◯	◯
I already have concrete plans what to do if something intervenes	◯	◯	◯	◯
I already have concrete plans what to do if I miss a physical activity and exercise session	◯	◯	◯	◯
I already have concrete plans what to do in difficult situations in order to stick to my intentions	◯	◯	◯	◯
I already have concrete plans when to especially watch out in order to stay committed	◯	◯	◯	◯

***52. Please endorse the 1 to 7 rating scale for each of the following items.**

How motivated are you to engage in physical activity and exercise regularly over the next month:

1 - Extremely Unmotivated	Quite Unmotivated	Slightly Unmotivated	Neutral	Slightly Motivated	Quite Motivated	7 - Extremely Motivated
○	○	○	○	○	○	○

***53. I strongly intend to do everything I can to engage in physical activity and exercise regularly over the next month:**

1 - Extremely Untrue	Quite Untrue	Slightly Untrue	Neutral	Slightly True	Quite True	7 - Extremely True
○	○	○	○	○	○	○

***54. How committed are you to engage in physical activity and exercise regularly over the next month:**

1 - Extremely Uncommitted	Quite Uncommitted	Slightly Uncommitted	Neutral	Slightly Committed	Quite Committed	7 - Extremely Committed
○	○	○	○	○	○	○

***55. We would like to obtain information about your average activity level during your leisure time over the past month. In leisure time, we also include walking to work, to the shops and so on. You can select more than one alternative if you take part in physical activity and exercise on several levels. We will then add up the total number of hours.**

Sedentary leisure time activities:

	Yes	No
Mostly sedentary activities	○	○

***56. Light physical activities which do not increase your breathing rate, such as slow walking or cycling, light swimming-pool exercise, swimming or gardening.**

○ Light exercise for 0.5-1.5 hours a week

○ Light exercise for 2-4 hours a week

○ Light exercise for more than 4 hours a week. Give the number of hours.

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***57. Moderate physical activity or exercise that increases your breathing rate or body temperature (perspiration), even if you can still keep talking while exercising. This includes brisk walking or cycling, walking on paths in nature, light jogging, moderately intensive gardening, pool exercise, aerobics, and so on.**

- ◯ Moderate exercise or physical activity for 0.5 - 1.5 hours a week
- ◯ Moderate exercise or physical activity for 2 - 4 hours a week
- ◯ Moderate exercise for more than 4 hours a week. Give the number of hours.

***58. Vigorous physical activity or exercise that noticeably increases your breathing rate and perspiration, such as fast walking, jogging, other strenuous aerobic or weight training, ball games, gardening and so on.**

- ◯ Vigorous activity for 0.5 - 1.5 hours a week
- ◯ Vigorous activity for 2 - 4 hours a week
- ◯ Vigorous activity for more than 4 hours a week. Give the number of hours.

***59. We would like to know how much you walk and lift at home and work during the week. Choose the alternatives that best correspond to your working tasks during the past month and give the number of hours you have devoted to these activities.**

Work at home:

Light domestic work including standing and walking, such as cooking, ironing, picking things up. _____ hours a week.

Moderate domestic work, for example, vacuum cleaning, weekly house cleaning, baking, lifting, and carrying loads of more than 10 lbs, such as small children. _____ hours a week.

Heavy repairs, lifting and carrying heavy loads, such as nursing an adult relative at home and so on. _____ hours a week.

*60. Workplace:

Mostly sedentary work - For the most part sedentary work, at a computer, for example _____ hours a week.

Light yet flexible work - You have a light job, during which you walk and stand quite a lot, includes working as a nurse, in a shop, doing light industrial work. _____ hours a week.

Moderately strenuous work - You have a fairly strenuous job, including walking, climbing stairs, heavy lifts of more than 10 lbs, such as nursing or service work, postman. _____ hours a week.

Heavy physical work - This includes heavy physical work involving heavy lifts, in connection with heavy nursing, stock or farming work. _____ hours a week.

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***61. For physical activity and exercise to be regular it must be done for 30 minutes per day, and be done at least 4 days per week. For example, you could take a 30-minute brisk walk or ride a bicycle for 30 minutes. Physical activity and exercise includes activities such as walking briskly, biking, swimming, line dancing, and aerobics classes or any other activities where the exertion is similar to these activities. Your heart rate and/or breathing should increase, but there is no need to exhaust yourself. Please answer the following questions with a Yes or No according to the definition above.**

	Yes	No
Do you currently engage in regular physical activity and exercise?	◯	◯
Do you intend to engage in regular physical activity and exercise in the next 6 months?	◯	◯
Do you intend to engage in regular physical activity and exercise in the next 30 days?	◯	◯
Have you been regularly physically active for the past 6 months?	◯	◯

***62. This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. For each of the following questions, please mark the circle that best describes your answer.**

In general, would you say your health is:

◯ Excellent ◯ Very good ◯ Good ◯ Fair ◯ Poor

***63. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities. If so, how much?**

	Yes, limited a lot	Yes, limited a little	No, not limited at all
Moderate activities such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	◯	◯	◯
Climbing several flights of stairs	◯	◯	◯

***64. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
Accomplished less than you would like	◯	◯	◯	◯	◯
Were limited in the kind of work or other activities	◯	◯	◯	◯	◯

***65. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
Accomplished less than you would like	◯	◯	◯	◯	◯
Did work or other activities less carefully than usual	◯	◯	◯	◯	◯

***66. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?**

◯ Not at all ◯ A little bit ◯ Moderately ◯ Quite a bit ◯ Extremely

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***67. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
Have you felt calm and peaceful?	◯	◯	◯	◯	◯
Did you have a lot of energy?	◯	◯	◯	◯	◯
Have you felt downhearted and depressed?	◯	◯	◯	◯	◯

***68. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc)?**

◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time

***69. Please respond to the questions related to your work participation on the following rating scale.**

	Very good	Good	Fair	Poor	Very poor
My chances of doing the paid work I want to do are	◯	◯	◯	◯	◯
My chances of doing my job the way I want to are	◯	◯	◯	◯	◯
My contacts with the people I work with are	◯	◯	◯	◯	◯
My chances of maintaining or changing my working role as I would wish are	◯	◯	◯	◯	◯
My chances of getting a different job are	◯	◯	◯	◯	◯
My chances of getting the training or education I want are	◯	◯	◯	◯	◯

Appendix F: Demographic Information on Chronic Pain Groups

	Fibromyalgia		Other Chronic Pain	
Variable	*M*	*(SD)*	*M*	*(SD)*
Age	45.8	(15.8)	40.3	(12.8)
Household income	$52,951	($55,255)	$44,150	($36,564)
Age of disability onset	31.1	(11.3)	29.3	(13.9)
Years since onset of pain	14.5	(9.8)	11.0	(9.5)
Body Mass Index (BMI)	30.7	(8.2)	30.2	(8.7)

Note: A BMI score of 30 and above indicates obesity