BANDURA'S SOCIAL COGNITIVE CONCEPTS AND PHYSICAL ACTIVITY OF PEOPLE WITH MULTIPLE SCLEROSIS:

A HIERARCHICAL REGRESSION ANALYSIS

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DEDICATION

I would like to thank the members of my Graduate Committee for their support and dedication to this project, my family and friends, and most importantly, RW.

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Abstract

BACKGROUND: Social Cognitive Theory (SCT), developed by Alfred Bandura, is a theory often employed for health promotion. This theory focuses on a set of determinants, examining how each operates, and translating information about the determinants into health practices. The combination and interaction of the primary determinants of SCT (perceived self-efficacy, outcome expectations, goals, and perceived facilitators and barriers) not only determine, but also influence the health behaviors individuals engage in. Through the use of this theory, determinants to change and adoption of a new behavior can be assessed, and individual treatment plans may be developed to effectively focus on the most influential targets for behavioral change. Multiple Sclerosis, a chronic and debilitating health problem estimated to affect hundreds of thousands of individuals in the United States, often leads to individual suffering and an overall decreased quality of life. Currently, there is no cure for MS, so symptom management and a decrease in debility remain a critical area of focus for health professionals working with MS patients. While there is no cure for this disorder, physical activity has been shown to alleviate multiple symptoms of MS such as mobility impairment, fatigue, pain, and depression, which then improves the quality of one's life. Furthermore, there is strong empirical evidence to support the use of SCT as an efficacious treatment approach for employing health promotion practices. The purpose of this study is to extend previous findings by examining how various SCT concepts relate to physical health, mental health, stage of change for exercise, and action planning and coping planning for exercise. Additionally, the present study examines how disability affects self-efficacy thereby impacting physical activity.

SUBJECTS: A total of 214 individuals (185 females [86%] and 29 males [14%] with self-reported MS recruited from the National Multiple Sclerosis Society and a neurology clinic of a

university teaching hospital in the Midwest participated in the current study. The average age among participants was 46.97 years (*SD* = 9.92). Around 36% of participants were retired due to MS, and approximately 72% of participants reported being treated for secondary health problems (e.g., overweight, high blood pressure, and diabetes).

METHOD: Participant demographic data were gathered from self-reports and include age, gender, ethnicity, marital status, years since onset of MS, secondary health issues, education level, vocational status, occupation, area of residence, current and past rehabilitation services received, source of income, total income, access to physical exercise in community, and changes in health practice since onset of MS. SCT concepts were assessed using the following measures: Action Self-Efficacy Scale-Physical Exercise (ASES-PE), Outcome Expectancy Scale-Physical Exercise (OES-PE), Health/Safety Risk Perceptions Scale (HRPS), Health/Safety Expected Benefits Scale (HEBS), Barriers to Health Promoting Activities for Disabled Persons Scale (BHADP), the Action Planning and Coping planning Scale-Physical Exercise (APCPS-PE), the Physical Activity Stages of Change Instrument (PASC). Participant disability and health were assessed using the following measures: Minimal Record of Disability (MRD) and the MOS Short form Health Survey (SF-12v2). The present study used a hierarchical regression analysis to examine associations between various domains and a set of social cognitive concepts (self-efficacy, knowledge of health and risk benefits, and outcome expectancy).

RESULTS: There were several significant findings when examining the four domains of action planning and coping planning, stage of change, physical health, and mental health. Results indicated action planning and coping planning was predicted by action self-efficacy (R^2 = 45%, β = .45, $p < .001$), outcome expectancy (R^2 = 45%, β = .20, $p < .01$), risk perception (R^2 = 45%, β = .14, $p < .05$), and perceived barriers (R^2 = 16%, β = -.14, $p < .05$). Results indicated that stage of

change was predicted by action planning and coping planning (R^2 = 28%, β = .26, p < .01). When "physical health" was the outcome variable, it was predicted by age (R^2 = 8%, β = -.20, p < .01), severity of disability (R^2 = 14%, β = -.28, p < .01), action self-efficacy (R^2 = 22%, β = -.16, p < .05), and outcome expectancy (R^2 = 22%, β = .27, p < .01). Lastly, when "mental health" was the outcome variable, it was predicted by age (R^2 = 6%, β = .18, p < .05), perceived barriers (R^2 = 11%, β = -.23, p < .01), outcome expectancy (R^2 = 18%, β = -.25, p < .01), and action self-efficacy (R^2 = 18%, β = .22, p < .05).

DISCUSSION: The research findings support the applicability of Bandura's Social Cognitive Theory as a model for exercise or physical activity for people with MS. This study found unique relationships between physical health and action self-efficacy, and mental health and outcome expectancy (with both relationships having a negative correlation). The current study includes a unique subset of the MS population who are well-educated, affluent, and report greater access to services and who expressed the negative correlate between action self-efficacy and physical health. The aforementioned factors are supposed to support physical health. However, the current group has high action self-efficacy to exercise, and given that they likely have good knowledge about exercise benefits to MS and good environmental support to engage in exercise, their motivation has likely surpassed, and is greater than, their experienced physical health, such as suffering pain and fatigue, which decreases physical health. Furthermore, it may be that the participants in the current study have good knowledge about how physical activity benefits their MS symptoms and progress management; consequently, they have high intention to push themselves to engage in exercise even though they may have experienced pain and fatigue, both of which have affected physical health significantly. Additionally, considering that high outcome expectations of a behavior may lead to stress and anxiety, such stress may decrease

mental health, particularly if the positive effects of an activity (such as exercise) are not experienced as soon as and as much as expected. Examining the social cognitive, physical health, and mental health domains provides a well-rounded and empirical basis for employing health promotion efforts in clinical work with persons with MS. Rehabilitation professionals may help persons with MS implement physical activity through the use of SCT, which may improve their mobility impairment, pain, fatigue, and depression. The present study's findings enable clinicians and rehabilitation professionals to better create and customize treatment to best meet individual patients' needs and improve their overall quality of life.

Keywords: social cognitive theory, multiple sclerosis, physical activity, health promotion

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LIST OF ABBREVIATIONS

MS – Multiple Sclerosis

SCT – Social Cognitive Theory

CHAPTER ONE

Introduction

Multiple Sclerosis (MS) is a chronic and disabling autoimmune disorder that occurs worldwide. It is estimated that 2 million individuals across the world, and approximately 250,000 to 350,000 people in the United States, are currently living with MS (Goldberg, 2011). Symptoms of MS can impact all facets of one's life and greatly alter overall quality of life. Mobility impairment, fatigue, pain, and depression are several common primary symptoms that affect many persons with MS. These symptoms interfere with activities of daily living, interpersonal relationships, personal autonomy, and ability to maintain employment. While there is no known cure, there are a variety of treatment options for the management of MS symptoms. And, evidence suggests that physical activity may be the most efficacious method of intervention and disease management (Goldberg, 2012; Motl, McAuley, Snook, & Gliottoni, 2009).

Social Cognitive Theory (SCT), developed by Alfred Bandura, has become accepted as one of the most influential and effective health promotion theories for developing and adhering to health promotion practices. Given this understanding, SCT may be used to identify determinants of change, encourage individuals with MS to become more physically active, and maintain this health behavioral change. Furthermore, literature raises concern about the sedentary lifestyle and physical inactivity that appears prevalent among individuals with MS. Consequently, such a sedentary lifestyle may result in additional health sequelae. Secondary health issues experienced by individuals with MS include, but are not limited to, diabetes, hypertension, obesity, and cardiovascular damage (Dalgas, 2011). These health issues may then further complicate and exacerbate MS symptoms thereby decreasing the patient's quality of life.

Regarding the most common MS symptoms, mobility impairment refers to the low levels

of muscle tone, challenge with balance and coordination, slowed movement, and gait impairment (van Asch, 2011). Mobility impairment impedes one's ability to carry out everyday activities and serves as a deterrent to engaging in physical activity. MS fatigue is an erratic symptom unique to the disease with sudden onset that is not necessarily alleviated through rest or sleep. Fatigue in MS is often experienced as exhaustion, and while it has a variety of physical effects, individuals with MS have also reported cognitive and mental fatigue (Olek, 2013). Due to the unpredictable nature and severity of fatigue, people with MS find this symptom to be particularly disabling.

Pain, another complex and multidimensional symptom of MS, is prevalent among persons with this disease. Persons with MS report a variety of chronic and acute types of pain. Such pain may range anywhere in severity from dull headaches, to stabbing sensations throughout the body, resulting in debility (Olek, 2013). Physically, there are numerous ways in which the aforementioned symptoms negatively affect an MS patient's quality of life; however, depression is another symptom that may have equally negative effects on individuals with this disease. MS drastically alters and changes various dimensions of one's life. Inability to maintain employment may occur, changes in social and personal functioning are often observed, and self-care may be further complicated and exacerbated by depression (Arnett, Barwick, & Beeney, 2008). Consequently, when one is depressed, various responsibilities that would be considered basic functioning may be jeopardized or seem overwhelming.

Given the scope and severity of the aforementioned symptoms (mobility impairment, fatigue, pain, and depression), it not surprising that individuals with MS may not be partaking in routine exercise or physical activity. However, according to the literature, physical activity as a treatment approach appears to be efficacious in addressing and managing symptoms of MS and

treatments focusing on physical activity have gained evidentiary support over the last few years (Dalgas, 2011). Additionally, literature suggests favorable outcomes for SCT as a theory to employ health promotion practices (Ferrier, Dunlop, & Blanchard, 2010). Social cognitive theory postulates that four components (self-efficacy, outcome expectations and goals, facilitators and barriers, and risk perception) interact with each other both directly and indirectly, serving in critical roles during various stages of change in individuals (Bandura, 2004). Promising outcomes utilizing SCT to promote physical activity have helped many individuals living with MS improve their quality of life, manage their symptoms, and maximize their functioning (Motl, McAuley, Snook, & Gliottoni, 2009). Thus, it is imperative to recognize the potential impact of physical activity on the management of MS symptoms.

The primary purpose of the present study is to examine Bandura's social cognitive concepts (2004) as a tool to assist individuals with MS to engage in self-managed physical activity (PA) or exercise on a regular basis, which in turn may improve quality of life by alleviating several key symptoms, most notably mobility impairment, fatigue, pain and depression. Specifically, considering that disability is regarded as a barrier to both self-efficacy and PA, the present study examines how disability affects self-efficacy thereby impacting PA. Based on Bandura's social cognitive concepts, the present study uses action planning as the proxy of Bandura's goal setting. While controlling for the contextual factors age, education, employment, and current chronic health problems, the present study explores how well “severity of disability”, “barriers to health promotion”, “action self-efficacy, outcome expectancy and risk perception”, and “severity of disability in relation to action self-efficacy” associates with (1) *action planning*, (2) *physical health*, (3) *mental health*; and (4) *stage of change*. The present study will use a hierarchical regression analysis to examine the hypotheses reflecting the above

purpose respectively by exploring the associations between social cognitive concepts and action planning, physical health, mental health and stage of change.

CHAPTER TWO

Review of Literature

Epidemiology of Multiple Sclerosis

The average age of MS onset typically occurs during the ages of 20 to 45 (Goldenberg, 2012). However, it occasionally presents in childhood or late middle age (Goldenberg, 2012). Approximately 250,000 to 350,000 people in the United States have MS, and it is estimated that 50% of those individuals will need assistance with walking within 15 years following the onset of the disease (Goldenberg, 2012). Two times as many women are affected as men, and while individuals of Asian, Hispanic, and African ancestry may develop MS, Caucasians (specifically individuals of Northern European descent) have the highest prevalence rate of the disease (Goldenberg, 2012).

As the demyelinating nature of the disease is unpredictable, almost any neurological and physical symptom can appear in patients with MS (Olek, 2013). However, some of the most common and debilitating symptoms include bladder and bowel dysfunction, vision problems, dizziness and vertigo, sexual dysfunction, cognitive impairment, mobility impairment, pain, depression, and fatigue (Goldenberg, 2012). It is critical to note that, "Fatigue occurs in 90% of patients and is the most common work-related disability associated with MS" (Goldenberg, 2012, p. 176). These symptoms affect all aspects of daily living, interpersonal functioning and overall quality of life.

There are multiple forms of MS. The four subtypes include Relapsing-Remitting MS (RRMS), Primary-Progressive MS (PPMS), Secondary-Progressive MS (SPMS), and Progressive-Relapsing MS (PRMS) (Olek, 2013). Individuals with RRMS experience attacks, or relapses, that tend to result in deterioration of neurological functioning, followed by periods of

time between the attacks in which there may be an absence of symptoms, or a time of remission (Goldenberg, 2012). Approximately 85% of MS patients are first diagnosed with this subtype (Goldenberg, 2012). Unlike RRMS, PPMS has no clear periods of remission or relapses, and its defining characteristic is the continual worsening of neurological symptoms over time (Goldenberg, 2012). The third subtype, SPMS, is normally diagnosed after a patient already has a RRMS diagnosis for some time. This course of disease develops more steadily; and remissions, or various flare-ups, may or may not be experienced (Goldenberg, 2012). Lastly, PRMS, the most uncommon subtype (diagnosed in approximately 5% of individuals with MS), usually presents as continued attacks of deteriorating neurological function (Goldenberg, 2012). In this form, the individual does not experience any periods of remission (Olek, 2013). While there are multiple therapies with disease-modifying agents effective in decreasing the duration and frequency of exacerbations, there is no FDA-approved cure to date (Goldenberg, 2012, p. 177). Since there is no cure for MS, self-management for this lifelong, chronic disease is critical.

Four Primary MS Symptoms

Mobility impairment, fatigue, pain, and depression are the four primary symptoms affecting MS patients' quality of life (Goldenberg, 2012).

Mobility Impairment. As one of the most common symptoms of the disease MS-related mobility impairment refers to a person's pronounced muscle weakness, gait impairment, difficulty with balance and coordination, and slowness of movement (van Asch, 2011). As the term implies, mobility impairment and extreme challenges in moving can prove to greatly impede MS patients' overall quality of life, activities of daily life, and negatively impact the decision to engage in physical activity (van Asch, 2011).

Individuals with MS typically present with low levels of muscle mass and strength, as well as low neural function (the ability to activate muscles; van Asch, 2011). Muscle strength may best be described as how much force muscles are able to exert. As a result of reduced muscle strength, individuals with MS typically experience greater muscle weakness and thus, less stamina (van Asch, 2011). Consequently, this results in overall reduced functional capacity (Dalgas, 2011).

Additionally, this muscle weakness can impair one's ability to walk. In fact, individuals with MS tend to experience the greatest mobility restraint in walking ability (van Asch, 2011). Walking is often particularly challenging for people with MS because they may face multiple difficulties such as having to lean to either side to swing legs forward or demonstrating a toe drag (van Asch, 2011). Also impeding individuals with MS' ability to walk is spasticity, as the feeling of muscle tightness may make it excruciatingly painful and therefore deter someone from walking or engaging in physical activity. Balance may also be impaired, and individuals with MS may demonstrate a swaying form of walking and struggle with movement such as getting up to move to another room or seating device. As reported by Morris, McAuley, and Motl (2008), many individuals with MS struggle with muscle spasms, balance difficulties, thermoregulatory problems, and muscle fatigue. These problems all have the potential to affect walking pattern, postural stability, functional ability, and the ability to engage in any physical activity whatsoever. Mobility may be additionally impaired by a sensory deficit of numbness in the feet. This numbness interferes with sensing contact with the ground making walking and moving in general particularly difficult. (Olek, 2013).

A study including 436 patients with MS found that 72% of participants reported mobility impairment had significantly affected their working life, everyday activities, and social life (van

Asch, 2011). Participants explained that normally simple tasks like preparing for their work day (showering, dressing, etc.) were overwhelmingly challenging due to physical limitations such as decreased muscle strength or lack of balance and coordination (van Asch, 2011). Additionally, feelings about mobility impairment due to MS were assessed with the most commonly chosen words being “limited”, “frustrated”, “powerless”, and “challenged” (van Asch, 2011). Mobility impairment has important implications for the quality of life in individuals with MS because difficulty with movement, including independent transportation, greatly limits the activities one may partake in. It also has a psychological effect on self-esteem and sense of independence. Both self-esteem and sense of independence, or ability to successfully complete a variety of tasks without the help of others or aids of objects, could affect an individual’s perception of their quality of life and overall happiness.

Fatigue. Fatigue is another primary, and disabling, symptom that affects a large number of individuals with MS (Kos, Kerckhofs, Nagels, D’hooghe, & Ilsbroukx, 2008). Studies suggest at least 65% of persons with MS experience fatigue on a daily basis, and 15%–40% report fatigue is one of the most disabling MS symptoms (Minden, Frankel, Hadden, Perloffp, Sinath, & Hoaglin, 2006). While there is definitive pathogenic factor to explain the origins of this fatigue, it may be a result of the disease mechanics or due to nondisease-specific factors (Kos et al., 2008). Primary fatigue is likely the result of demyelination or axonal loss (Kos et al.). A nondisease-specific factor that may result in fatigue includes sleep problems, which are commonly present in MS (Kos et al.).

Fatigue in MS typically has a sudden onset and often persists even after an adequate amount of rest or sleep (Kos et al., 2008). General fatigue is categorized as general, cognitive fatigue, lack of energy, lack of motivation, mental fatigue, tiredness, and lack of motivation (Kos

et al.). Some of the defining characteristics of MS-specific fatigue include exhaustion that typically becomes more severe as the day continues, fatigue that is exacerbated by weather (specifically humidity and heat), fatigue with a rapid onset, fatigue that disrupts one's ability to complete typical activities of daily living (or responsibilities), and fatigue that is experienced every day. In other words, MS fatigue is perpetual (Hadjimichael, Vollmer, & Oleen-Burkey, 2008). Fatigue in persons with MS is often associated with the perception of impaired general health, mental state, and quality of life (Bakshi, 2002). This symptom has a significant negative impact on persons with MS and their performance in work, social activities, daily life, and at home (Vercooulen, Homes, Swanink et al, 1996). Fatigue may be easily triggered and is often unexpected. Consequently, this symptom may limit physical and mental activity and may restrict participation in everyday activities (Kos et al.).

A survey study conducted by Hadjimichael, Vollmer, and Oleen-Burkey (2008) sought to identify the severity and impact of fatigue and its relationship with other clinical parameters of MS, such as physical disability. The study included 9,077 persons with MS enrolled in the North American Research Committee on Multiple Sclerosis. Severe fatigue was reported by 74% ($p <$ .0001) of respondents (6691 people) (Hadjimichael,Vollmer, & Oleen-Burkey, 2008). Additionally, a higher prevalence of severe fatigue was observed in relapsing-worsening MS (59.8%) compared with relapsing-stable (32.6%) and primary progressive (7.6) (Hadjimichael et al., 2008). Furthermore, severe fatigue was often cited as the cause of early retirement or inability to maintain employment (Hadjimichael et al.). Participants of the study with severe fatigue also had significantly higher mobility impairment ($t = 4.22$, $p < .0001$) as measured by PDDS scores compared with respondents with mild/moderate fatigue ($t = 2.58$, $p < .0001$), which

impacted participants' ability to carry out activities of daily life and engage in physical activity (Hadjimichael et al.).

Pain. Pain is another complex and multidimensional symptom affecting MS patients. Clinically significant pain has been reported by as many as 65% of persons diagnosed with MS (Kerns, Kassirer, & Otis, 2002). Individuals with MS often experience an array of both chronic and acute pain (Kerns et al., 2002). Types of chronic pain experienced include spasticity, muskculoskeletal pain and headaches (Saffir & Rosenblum, 2002). Several conditions secondary to MS that cause acute pain include trigeminal neuralgia, optic neuritis, L'Hermite's phenomenon and tonic seizures (Saffir & Rosenblum, 2002).

Spasticity is a frequent and uncomfortable problem for a number of persons with MS. Spasticity is described as a "velocity-dependent increase in tone and involves muscle stiffness, involuntary muscle movement, and increased reflexes" (Saffir & Rosenblum, 2002, p. 140). Spasticity impacts every feature of function and quality of life as the painful and uncontrollable spasms negatively affect mobility, daily function, self-care, hygiene, and sleep (Saffir & Rosenblum, 2002). Additionally, spasticity makes controlled movement of weak muscles very challenging and has no set course, so it may vary from day to day (Saffir & Rosenblum, 2002).

For many individuals with MS, problems with spasticity weakness may result in musculoskeletal changes that affect posture and body positioning (Saffir and Rosenblum, 2002). Consequently, these changes may increase strain on the bones, muscles, joints, ligaments, tendons, and nerves, resulting in pain (Saffir and Rosenblum, 2002). These changes in posture lead to lower back pain and decreased ambulatory status (Saffir and Rosenblum, 2002). Additionally these musculoskeletal changes cause stress to be placed on other body regions,

which causes further health complications, such as carpal tunnel syndrome, ultimately resulting in physical limitation (Saffir & Rosenblum, 2002).

Cluster headaches and migraines are also commonly experienced in persons with MS (Saffir & Rosenblum, 2002). These headaches and migraines are usually severe, unilateral and last several hours to several days (Saffir & Rosenblum, 2002). Trigeminal neuralgia, a type of acute pain, affects the fifth cranial nerve, and is experienced as a sharp, intense stabbing pain in the face and jaw (Saffir & Rosenblum, 2002). This pain is experienced for a few seconds, and the frequency of attacks is variable (Saffir & Rosenblum, 2002). It may spur from movements such as talking, drinking, chewing or by sensory stimulus to the teeth, face, or "mucosa-such as brushing the teeth" (Saffir and Rosenblum, 2002, p. 135). Another acute pain, optic neuritis, refers to inflammation of the optic nerve, which causes pain from eye movement (Saffir & Rosenblum, 2002).

Persons with MS often experience additional visual problems and pain. These include central scotoma, loss of vision, and changes in perception of color, or color vision (Saffir & Rosenblum, 2002). It is also common for persons with MS to experience tonic seizures, which are sudden and unexpected uncontrollable episodes of spasms or painful positions that are often preceded by pain (Saffir & Rosenblum, 2002). Painful tonic seizures may include falling, dysarthria, ataxia, and sometimes pelvic pain (Honig, Wasserstein, & Adornato, 1991). These episodes typically occur multiple times a day and may last anywhere from a few seconds to several minutes (Honig et al., 1991). These tonic seizure spasms differ from "true spasticity - which is a velocity-dependent increase in tone" and occur spontaneously or are triggered by tactile stimulation or movement (Saffir & Rosenblum, 2002, p. 140). Pain from tonic seizures is experienced as significant, intense tingling and burning (Saffir & Rosenblum, 2002).

L'Hermitte's phenomenon is a pain or tingling that radiates down the spine, at times extending to the legs, and is caused by passive flexion of the neck (Saffir and Rosenblum, 2002).

MS patients may experience pain which impacts their ability to carry out activities of daily living, maintain employment, engage in physical activity, and affects their overall quality of life in a variety of ways. Kalia and O'Connor (2005) examined the effect pain had on various dimensions of psychosocial functioning in 99 patients with MS. Participants completed several self-administered surveys to assess pain, quality of life, and mental health (Kalia & O'Connor, 2005). Results indicated that chronic pain in MS was correlated with a reduced perceived quality of life ($r = .44$, $p < .0001$), particularly mental health (Kalia & O'Connor, 2005). Archibald and colleagues sought to identify the impact of pain in persons with MS on their psychosocial functioning. Out of 85 participants, 57% reported that their ability to work had been reduced by 50% or more because of pain (Archibald et al., 1994). Additionally, participants reported significantly poorer functioning across domains such as physical activity, personal and social relationships, and executing activities of daily living.

Depression. While pain may prove to be an incredibly debilitating physical symptom of MS, depression is another symptom that may have equally negative effects on individuals with this disease. It is estimated that individuals with MS are at a 50% lifetime risk for depression (Arnett, Barwick, & Beeney, 2008). Patten and colleagues (2003) conducted a study including persons with and without MS to determine the prevalence of major depression in persons with MS, in persons with other chronic conditions, and in persons without MS. Results suggested the annual prevalence of major depression in persons with MS is considerably higher compared to both healthy people and persons with other chronic health conditions (Patten, Fridhandler, Beck,

& Metz, 2003). Examiners reported a 12-month prevalence rate of 25.7% for major depression in persons with MS who were between 18-45 years of age (Patten et al., 2003).

Siegert and Abernethy (2005) explain that persons with MS may be prescribed various pharmacological treatments to alleviate various symptoms. However, as a side effect, these pharmacological treatments may put the patient at risk for depression. Additionally, the use of interferon medications, or corticosteroids, which are prescribed to alleviate and treat MS attacks could instigate or intensify depression (Siegert & Abernethy, 2005). The progression of the disease may also put people with MS at risk for experiencing depression since the course of MS has the potential to destroy various nerve fibers and myelin within the brain (Arnett, Barwick, & Beeney, 2008). Multiple changes in affect and behavior may occur if components of the brain that play a key role in emotional regulation and interpretation (like areas of the dorsolateral prefrontal cortex) are affected (Arnett et al., 2008). Siegert and Abernethy (2005) explain that individuals with MS often report an array of emotional states ranging from feeling sad for short periods of time, to more severe states of clinical depression which may last anywhere from a few months to years. One's life changes immensely with the onset of MS. Changes in employment, social and personal functioning, and self-care, which are already greatly impacted by symptoms such as mobility impairment, fatigue and pain, may be further complicated and exacerbated by depression. Consequently, when one is depressed, various responsibilities typically considered basic functioning may be jeopardized or seem overwhelming (Arnett, Barwick, & Beeney, 2008).

Physical Activity for People with Multiple Scleroses

Evidence of Physical Inactivity in Persons with MS. The combination of the aforementioned primary MS symptoms, coupled with doubt of ability to cope and manage

symptoms, often leads to reduced functional capacity (Döring, Pfueller, Paul, & Dörr, 2012). As a result of negatively impacted functional capacity in individuals with MS, a decrease in both organized and unorganized physical activity and perceived quality of life has been observed (Dalgas, Stenager, & Ingemann-Hansen, 2008; Döring, Pfueller, Paul, & Dörr, 2012). In comparison to persons without the disease, results from a meta-analysis of 13 studies with 2,360 participants with MS indicate that persons with MS are considerably less physically active (Motl, 2005). Individuals with MS report difficulty carrying out daily activities and a sense of being overwhelmed with managing day-to-day tasks, work, and relationships. As a result of premature health issues, individuals with MS are less physically active, and are more likely to be engaged in less consistent exercise behavior than the general population (Campbell, Sheets, & Strong, 1999).

Beckerman and colleagues (2010) sought to identify levels of physical activity, and factors associated with physical activity in adults with MS. Participants in this study included 106 people with MS (M_{age} = 42.8) and physical activity was assessed using the Short Questionnaire to Assess Health-Enhancing Physical Activity (Beckerman, de Groot, Scholten, Kempen, & Lankhorst, 2010). The roles that demographic, cognitive-behavioral, and environmental factors and disease characteristics had on physical activity were assessed using the Expanded Disability Status Scale (EDSS), Fatigue Severity Scale (FSS), Center for Epidemiologic Studies Depression (CES-D) Scale, Cumulative Illness Rating Scale (CIRS), the EuroQol 5-domain index (EQ-5D), 12-item Self-Efficacy for Exercise Behavior Scale, Physical Activity Enjoyment Scale, and the 5-item Exercise Stage of Change Questionnaire (Beckerman et al., 2010).

Results indicated that 64% (68 out of 106) of participants were either sedentary or deficient in terms of physical activity (Beckerman et al., 2010). With regards to demographic variables, disability pension, age and having children to look after were significantly related to less physical activity (β = -.23, -.26, -.26, respectively, R^2 = 29.4%, $p < .05$; Beckerman et al.). Of the cognitive and behavioral variables examined, a significant correlation was found between perceived personal barriers and physical inactivity (β = -.31, R^2 = 12%, $p < .05$; Beckerman et al.). Additionally, a significant correlation was found between a high EDSS score (more severe fatigue) and less physical activity variance (β = -.22, R^2 = 28%, $p < .05$; Beckerman et al.). This study indicates that persons with MS exemplify less physically active behaviors and that the severity of symptoms appears to be associated with less physical activity. Additionally, results imply that the role of perceived personal barriers in people with MS negatively affects their decision to engage in physical activity. More specifically, the study suggests that mobility impairment and fatigue may play a role in such perceived barriers, MS patients may believe they are less capable of engaging in physical activity than they actually are, citing fatigue and mobility impairment (Beckerman et al.).

Consequences of Physical Inactivity. A physically inactive or sedentary lifestyle may result in an increased risk for developing a myriad of secondary health issues. Such health issues include obesity, osteoporosis, diabetes, and cardiovascular damage (Dalgas, 2011). Further, such cardiovascular damage may increase the risk of additional health complications such as pulmonary embolisms, upper respiratory infections or thrombosis (Döring, Pfueller, Paul, & Dörr, 2012). More recently, cardiovascular comorbidities have been related to increased disability in persons with MS (Marrie et al., 2010).

As cited in a study by Morris, McAuley, and Motl (2008), these secondary health issues

may be a result of inactivity in individuals with MS, despite well-established physical and psychological benefits (Morris, McAuley, & Motl, 2008). Nosek et al. (2006) suggests difficulty managing weight due to physical inactivity may serve as a catalyst for multiple secondary conditions that could otherwise be prevented, as well as emotional frustration and irritation (Nosek, Hughes, Robinson-Whelen, Taylor, & Howard 2006).

Campbell and colleagues noted that individuals with chronic physical disabilities such as MS typically face a variety of health issues that are common among older individuals and experience aging much sooner than individuals their age without physical disabilities (Campbell, Sheets, & Strong, 1999). Furthermore, people with MS often experience a shorter life span than those without the disease due to health sequelae, such as cardiovascular damage from physical inactivity (Motl, Fernhall, McAuley, & Cutter, 2011).

A cross-sectional study by Nosek et al. (2006) included over 400 women with a variety of physical disabilities including MS. Researchers discovered that participants identified an average of 14.6 health problems along with their primary disability. The majority of participants reported excessive weight, pain, and fatigue as the most common additional health problems (Nosek et al.). Participants explained that pain and mobility impairment were two of the most influential problems that interfered with engaging in exercise (Nosek et al.). Furthermore, more than half of the subjects had circulatory problems, sleep disturbance and high blood pressure, while more than one third identified having diabetes (Nosek et al.). Literature suggests an inactive lifestyle leads to increased risk of multiple secondary healthy problems among individuals with MS (Dalgas, 2011). Consequently, these health issues, in addition to symptoms of MS, typically result in individuals with MS reporting a lower quality of life and a more inactive lifestyle (Dalgas, 2011).

Benefits of Physical Activity on People with MS. As clearly evidenced, MS is associated with multiple severely debilitating symptoms such as mobility impairment, fatigue, pain, and depression. However, physical activity (PA), has been shown to alleviate the aforementioned symptoms, which in turn improve the quality of one's life (Beckerman, de Groot, Scholten, Kempen, & Lankhorst, 2010).

Sullivan, Scheman, Venesy, and Davin (2012) note the many benefits of incorporating routine physical activity into the lives of those with MS. One of the greatest benefits is that engaging in exercise leads to the production and release of endorphins (Sullivan, Scheman, Venesy, & Davin, 2012). Endorphins, in turn, assist in blocking the experience and feelings of pain and also induce a state of relaxation (Sullivan et al., 2012). Furthermore, there is a correlation between exercise and weight loss, which is beneficial in managing chronic pain because there is less weight on joints, thereby lessoning pain (Sullivan et al.). This is an important point, as obesity may be a health sequale of MS (Dalgas, 2012). Furthermore, participating in routine exercise assists in strengthening core muscles, which are often observed to weaken with the course of MS (Sullivan et al., 2012). Core muscles are responsible for supporting cartilage and bones, maintaining joint flexibility, and serving as a brace for larger bone structures that are typically affected by pain (Sullivan et al.). If core muscles are weak, and a decrease in muscle strength is present, persons with MS experience significantly increased pain; therefore, exercise is an important tool for managing chronic pain that occurs in MS (Sullivan et al.). While mobility impairment (from spasticity or decreased muscle strength) in individuals with MS may originally be explained by the natural disease progression, it may be exacerbated by physical inactivity (Döring, Pfueller, Paul, & Dörr, 2012). More specifically,

evidence suggests that physical activity improves a number of MS symptoms, particularly mobility-related impairment (Döring et al., 2012).

Motl and colleagues (2009) examined the relationship between physical activity and quality of life, as well as patterns of relationships among social support, self-efficacy, pain, mood, fatigue, disability, quality of life, and physical activity. Participants (N = 292 people with MS) wore an accelerometer for one week. Following the seven days, participants completed self-report measures of social support, self-efficacy, pain, mood, fatigue, disability, quality of life, and physical activity (Motl, McAuley, Snook, & Gliottoni, 2009). A statically significant relationship was found between physical activity and quality of life (r = .34, X^2 = .12, p < .05), and indicated that persons with MS who were more physically active reported a higher level of quality of life (Motl et al., 2009). Results further indicated that participants who engaged in more physical activity reported significantly (R^2 = 51.3 %, p < .001) greater social support (r = .20), self-efficacy for managing MS (r = .41) and self-efficacy for regular physical activity (r = .49) and less fatigue (r = -.46), pain (r = .19), depression (r = -.31), and disability (r = -.50; Motl et al.). Corroborating this finding, it has been suggested that when individuals with MS engage in physical activity, one of the primary results is decreased depression and fatigue, and increased quality of life compared to people with the disease who are not physically active (Dlugonski, Wojcicki, McAuley, & Motl, 2011).

A randomized controlled trial with 36 persons with MS examined the effects of long-term resistance training (either with or not in combination with simultaneous electro-stimulation) on overall functional mobility and leg muscle strength (Broekmans et al., 2011). Results showed improved muscle strength and functional mobility regardless of whether participants received electro-stimulation or not (p < .05) (Broekmans et al., 2011). Cakit and colleagues (2010)

observed positive effects of resistance training on functioning in people with MS as well. In that study, participation in a resistance program, walking speed, stair climbing, self-reported disability, self-reported fatigue, and gait disturbances were significantly improved (Cakit et al., 2010).

Further supporting these findings, Motl and colleagues (2008) examined the relationship between physical activity in persons with MS and worsening of MS symptoms over a three to five year period. Participants (n = 51, mean age = 44.7) were interviewed to assess worsening of their symptoms, while physical activity was measured using the International Physical Activity Questionnaire (IPAQ) (Motl et al., 2008). Results indicated that 35 (69%) out of the 51 participants reported worsening of symptoms over the three to five year period (Motl et al.). Additionally, an ANOVA analysis suggested that the scores on the IPAQ varied based on worsening of symptoms [$F(1, 45) = 4.15$, $p < .05$], meaning worsening of symptoms was associated with lower levels of reported physical activity (Motl et al). These findings point out how critical a role physical activity plays in managing MS symptoms (Motl et al.). The aforementioned studies provide significant implications for persons with MS. They suggest the effect physical activity has on an array of domains, most notably management of MS symptoms and increased quality of life. Additionally, there is further evidence of the need for health professionals to encourage individuals with MS to engage in physical activity.

Previous health promotion theories have sought to identify predictors to engaging in health behavior (Bandura, 2004). While this information is useful, it is not necessarily the most effective way to identify *how* to encourage one to engage in positive health practices. However, an applied theory that health professionals have used in the hopes of achieving this health promoting behavior is Bandura's Social Cognitive Theory (SCT). This theory is explained in

greater detail in the following section. This theory considers both personal and environmental factors in order to identify a proactive plan for change. Furthermore, SCT is a theory that serves to empower people as it rests with the understanding that personal change is possible. For each population, or person, this theory may be tailored to identify what variables are most critical to that entity as related to adopting positive health behavioral change.

Using Bandura's Social Cognitive Theory to Promote Exercise Behavior

Theory Review. Social Cognitive Theory (SCT), developed by Alfred Bandura, is a theory that is often employed for health promotion (Bandura, 2004). Before discussing the application of SCT and its use for health promotion behavior, it is critical to understand the primary components of the original theory. Social Cognitive Theory focuses on a set of determinants, the way they operate, and translating information about these determinants into health practices (Bandura, 2004). The combination and interaction of the primary determinants of SCT (perceived self-efficacy, outcome expectations, goals, and perceived facilitators and barriers) greatly determine and influence the health behaviors individuals engage in (Bandura, 2004).

Knowledge of health benefits and risks serves as a key precursor to change (Bandura, 2004). If one is unaware of negative consequences of their lifestyle habits, they are unlikely to sense any need to change. However, providing information about risks and benefits of lifestyle habits increases the chances of considering a change in behavior (Bandura, 2004). Self-efficacy is another component to personal change. If one does not believe in their ability to change or maintain an action, they are unlikely to act or maintain change if difficulties arise (Bandura, 2004). Bandura emphasizes the importance of this determinant, describing self-efficacy as the "foundation of human motivation and action" (Bandura, 2004, p. 144). A primary purpose of

self-efficacy within SCT is to elucidate how an individual's perceptions of their ability can influence and shape a variety of behaviors and reactions. These behaviors and reactions include their affect behavior, motivational level, patterns of thought, and emotional reactions (Bandura, 2004).

Outcome expectations affect one's desire to engage and maintain health behavioral change, and such expectations take multiple forms (Bandura, 2004). There are physical outcomes, which consist of both positive and negative effects of a particular behavior. For example, if one engages in exercise they may lose weight (positive effect); however, they may also experience sore muscles (negative effect). Additionally, there are social outcomes individuals may experience in response to their behavior. For instance, sedentary behaviors may not be approved by family and friends (negative feedback), or individuals may receive encouragement and support from others when they exercise (positive feedback) (Bandura, 2004). The final type of outcome relates to negative and positive self-evaluative reactions to one's own health status and health behavior (Bandura, 2004). People develop and adopt standards upon which they aspire to behave, and ultimately monitor their behavior based on self-evaluative reactions (Bandura, 2004). People will engage in behavior they find self-worth in and perceive as pleasurable, and avoid actions that result in self-dissatisfaction (Bandura, 2004). Outcome expectations are one of the key components in influencing initial motivation and the decision to alter one's health behavior (Bandura, 2004). There are an array of health behaviors that may require a slight change or alteration, but if the individual's notion of the consequences and benefits of such change are unclear, their decision to engage in the activity may be dependent on their perception of outcome expectations (Bandura, 2004). While a perceived positive outcome

expectation would result in engaging in the behavior, a perceived negative outcome expectation would result in avoiding the behavior (Bandura, 2004).

Goals are also a vital component to enhancing motivation and behavioral change. If one establishes goals that are in their best interest and based on a personal value system, such goals are likely to provide incentive and motivation to engage in behavioral change (Bandura, 2004). Long-term goals provide a direction for personal change, while short-term goals assist individuals in succeeding by guiding their present behavior (Bandura, 2004).

The final component of SCT includes one's perceived facilitators and barriers in relation to behavioral change (Bandura, 2004). Barriers may include factors that are personal, social, economic, and environmental. If one perceives little to no barriers, an action may be easily performed which may positively affect self-efficacy (Bandura, 2004). Conversely, if one perceives multiple barriers and few facilitators in relation to a behavior, they are unlikely to be successful in carrying out an action, which would negatively affect perceived self-efficacy. Perceived facilitators and barriers play a key role in the formation of self-efficacy, such that if one feels that they are overcome with barriers and lacking in facilitators, their self-efficacy may be lower as a result of interpreting challenges to engage in performance successfully (Bandura, 2004).

Bandura explains how self-efficacy serves to influence the remaining three determinants in both a direct and indirect manner. Bandura notes that one's self-efficacy shapes their goals, which as a result means that the greater the self-efficacy, the more challenging goals people will establish while also employing greater persistence and commitment to such goals (Bandura, 2004). Outcome expectations are shaped by self-efficacy in the sense that individuals with greater self-efficacy are more likely to envision a positive outcome of their behavior, whereas

individuals with weaker self-efficacy are more likely to forecast a negative outcome (Bandura, 2004). Self-efficacy also has the ability to affect the way people interpret barriers. For instance, individuals with a high self-efficacy are likely to continue with the original behavior change and persist with this behavior even in the most challenging and difficult situations. Conversely, people with a lower self-efficacy may give up more easily when obstacles arise (Bandura, 2004). In the SCT framework, it is believed that self-efficacy affects health promotion habits both indirectly and directly (Bandura, 2004). Additionally, self-efficacy indirectly and directly affects outcome expectations, goals, and facilitators and barriers, all three of which then, when working in conjunction, ultimately affect and influence health-promoting behavior (Bandura, 2004). Social cognitive theory is unique as it not only considers predictors of health habits, but also utilizes several principles to educate, enable, inspire, and guide people to modify new behaviors that promote a healthy lifestyle (Bandura, 2004).

Social cognitive concepts (self-efficacy, outcome expectations, goals, and facilitators and barriers) influence one another directly and indirectly, and serve as differing roles during various stages of change in individuals. Each of these concepts are critical for behavior change, and an adaptation or slight alteration in one domain may have implications for behavior or greatly impact another domain preceding behavioral change. It is important to consider how disability and other barriers to physical activity faced by persons with MS affect such SCT concepts.

New health behaviors are not easily adopted and are certainly not attained through an act of pure will (Bandura, 2004). Motivation and self-regulation are critical when enacting such a change, which may be difficult to cultivate when one is facing various barriers, including debility (weakness, or a loss of strength) and disability. Persons with MS report a lower sense of self-efficacy, perceive greater barriers than do those without the disease, and have a sense of limited

ability to self-manage their disease (Shnek et al., 1997). Given this understanding, it is clear that disability and debility can critically shape and impact one's self-esteem, goals, and outcome expectations.

Bandura emphasizes the need for individuals to monitor their actions and use short-term goals as an aid and incentive to engage in change and to guide their behavior (2004). If persons with MS feel overwhelmed with barriers, they are unlikely to develop a healthy sense of self-efficacy, which in turn would affect their ability to create incentives to engage in and maintain health promoting behaviors (Bandura, 2004). Additionally, if a person with MS feels little to no self-efficacy, they are unlikely to identify ways to overcome barriers, utilize facilitators, and focus on positive outcome expectations (Bandura, 2004). This would then greatly decrease the likelihood of engaging in physical activity. In terms of goal setting, if a person creates goals that are too lofty or unrealistic, they are unlikely to experience success with their behavior, thereby resulting in a negative outcome and ultimately negatively impacting their self-efficacy (Bandura, 2004). Furthermore, if individuals with MS are unaware of the numerous benefits of engaging in physical activity, such as symptom management, they are unlikely to sense a need to alter their current behavior. Additionally, persons with MS may be unaware of the risks of a sedentary lifestyle and the secondary health issues that may arise as a result of being inactive. This lack of knowledge about health risks and benefits impacts several domains of SCT. If someone is unaware of a need to change, they are highly unlikely to consider their self-efficacy on the topic, create goals, envision outcome expectations, and utilize facilitators (Bandura, 2004).

Review of the Related Empirical Studies Applying Social Cognitive Theory to People with Multiple Sclerosis. Doersken, Motl and McAuley (2007) sought to identify what Social Cognitive Theory (SCT) concepts play a role in participants with MS (N = 196) partaking

in physical activity. The results demonstrated several environmental factors (facilitators) that play a key role in promoting physical activity. The authors note that the presence of amenities that could be accessed through walking (r = .20; p = .18), access to low cost facilities (r = .16; p = .15), and closer distance to transit stops (r = .20; p = .16) were correlated with greater levels of physical activity in persons with MS (Doerksen, Motl, & McAuley, 2007). Consistent with Bandura's SCT, fewer barriers were perceived and a higher sense of self-efficacy was present, which likely led to fulfillment of the goal of participating in physical activity (Bandura, 2004).

Morris, McAuley, and Motl (2008) examined the independent roles of components of SCT, which included perceptions regarding self-efficacy, environmental and functional limitations in regards to their influence and role in participation of physical activity. Participants in this cross-sectional study included older women without MS (N = 136, M_{age} = 69.6 years) as well as women who were diagnosed with MS (N = 173, M_{age} = 46.1 years). Several measures assessed self-efficacy [Exercise Self-Efficacy Scale (EXSE)], perceptions of the physical environment (Neighborhood Environment Walkability Scale- NEWS), functional limitation (Late Life Function and Disability Instrument-LL-FDI), and physical activity (through the use an Actigraph accelerometer; Morris, McAuley, & Motl, 2008).

The findings indicated that functional limitations and self-efficacy were the strongest correlates of physical activity, among the sample of women with and without MS (Morris, McAuley, & Motl, 2008). Results indicated a statistically significant correlation between physical activity and self-efficacy in both women with and without MS (r = .34 and r = .42 respectively; Morris, McAuley, & Motl, 2008). Additionally, functional limitations were significantly related to physical activity in both samples (r = -0.46, and r = -0.41; Morris, McAuley, & Motl, 2008). Furthermore, regression analyses revealed the independent influence

of access to services, physical activity, land use diversity, self-efficacy and functional limitations were significant [F (41,68) = 16.58, $p < 0.01$, $R^2 = 28\%$; Morris, McAuley, & Motl, 2008]. However, only functional limitations ($\beta = -0.38$, $p < .01$) and self-efficacy ($\beta = 0.22$, $p < .01$) accounted for unique variance in physical activity, whereas environmental factors were non-significant (Morris, McAuley, & Motl, 2008). The authors note that social cognitive theory would postulate there is both a direct and indirect influence of functional limitations on physical activity as they may adversely impact and affect self-efficacy cognitions (Morris, McAuley, & Motl, 2008).

However, physical activity self-management can be incredibly difficult, and a change in behavior in order to engage in physical activity is not likely to develop without significant motivation (Chiu, Lynch, Chan, & Berven, 2011). This brings to light the importance and role of self-efficacy, as it is unlikely individuals with MS will learn and practice adaptive physical activity self-management techniques if they are lacking in this construct. Self-efficacy is the source for motivation, and then goal setting allows one to actualize motivation while also serving as the agent of intention. Moreover, goal setting bridges self-efficacy and intent to produce an actual behavior change.

Motl, Snook, McAuley, Scott and Douglass (2006) adopted a social cognitive perspective to examine self-efficacy, enjoyment of physical activity, social support, and disability as it related to participation in physical activity among persons with MS (Motl et al., 2006). Participants in the study included 196 persons (23 men, 173 women, M_{age} = 46.1 years) with MS (Motl et al.). Measures included the Exercise Self-Efficacy Scale (EXSE), Physical Activity Enjoyment Scale (PACES), Social Provisions Scale (SPS), Late Life Function and Disability Instrument (LL-FDI), the Godin Leisure-Time Exercise Questionnaire (GLTEQ), and the use of

an Actigraph accelerometer (Motl et al.). Results showed that enjoyment of physical activity (r =. 38, p <. 001), social support (r = .15, p < .05), and disability (r = .18, p < .01) had statistically significant direct relations with self-efficacy (Motl et al.). Furthermore, self-efficacy (r = .29, p <. 001) and enjoyment of physical activity (r = .28, p < .001) were significantly and directly related with self-reported physical activity, and explained 19% of the variance (Motl et al.). The authors discuss the importance of examining physical activity enjoyment and self-efficacy as two critical factors for an intervention with the intent to increase physical activity among persons with MS (Motl et al.).

Dlugonski, Wojcicki, McAuley and Motl (2011) sought to identify which specific SCT correlates play a critical role for engaging people in health promoting behaviors, such as exercise. This was the first experiment to incorporate all four SCT variables in one study as it relates to physical activity in sedentary people with MS. The inclusion of all four SCT variables allowed researchers to examine which components of SCT may be the most critical in terms of influencing an individual to engage in positive health behaviors.

The study included 54 participants who were diagnosed with relapsing remitting MS (RRMS). Information gathered about participants included gender, ethnicity, age, marital status, time elapsed since diagnosis, and employment status. Participants were asked to complete various self-report scales that measured physical activity, self-efficacy, outcome expectations, functional limitations, goal setting, and neurological disability. The measures used to assess each of the aforementioned items included the Godin Leisure-Time Exercise Questionnaire (GLTEQ), Exercise Self-Efficacy Scale (EXSE), Multidimensional Outcomes Expectations for Exercise Scale (MOEES), Functional Limitations component of the abbreviated Late-Life

Function and Disability Instrument (LL-FDI), Exercise Goal-setting Scale (EGS), and the Patient Determined Disease Steps Scale (PDDS) (Dlugonski, Wojcicki, McAuley, & Motl, 2011).

The results showed that outcome expectations and barriers had a moderate degree of association with participants' engagement in physical activity. Furthermore, the results revealed significant correlations between physical activity and exercise goals (r = .31, p = .01), physical activity and outcome expectations (r = .29, p = .02), and physical activity and functional limitations (r = .28, p = .02; Dlugonski, Wojcicki, McAuley, & Motl, 2011). A final multiple linear regression analysis model [$F(1,52) = 5.47$, p = .023] indicated only goal setting scores as a statistically significant correlate with physical activity scores (β = 0.31, P = .023), with goal setting explaining 10% of the variance in self-reported physical activity (Dlugonski, Wojcicki, McAuley, & Motl, 2011).

Furthermore, the authors concluded that participants who identified more optimistic social expectations reported fewer functional limitations, more goal setting techniques, and engaging in more physical activity (Dlugonski, Wojcicki, McAuley, & Motl, 2011).

A past study conducted by Ferrier (as cited in Dlugonski, Wojcicki, McAuley and Motl, 2011) found a positive relationship among physical activity and outcome expectations in individuals with MS (β = .27, p < .023). Similarly, the study conducted by Dlugonski, Wojcicki, McAuley and Motl (2011) also found a positive relationship between physical activity and outcome expectations (r = .29, p < .02). The authors also concluded their study supported the use of the four variables from social cognitive theory as targets of intervention for changing physical activity behavior in inactive persons with MS.

This study is particularly important because it is the first to examine the role of the four components of social cognitive theory as correlates of physical activity in persons with MS or

included a sample of inactive persons with MS who were volunteering for a behavior change intervention. By simultaneously assessing each of the four variables, specific information may be gathered in terms of what variables, or targets, should take precedence when considering what areas of cognition best correlate to initiating, or altering, a behavioral change for physically inactive persons with MS. Furthermore, this study provides empirical support that engaging in physical activity alleviates multiple symptoms of MS.

While this study serves to further our understanding of the role of the four components of social cognitive theory, limitations of the design must be considered. First, this study did not include further contextual information, such as history of education, information pertaining to additional health problems, and greater detail of employment. Having this information would have allowed for the consideration of how cultural, economic and social factors affect the results. Secondly, the study focused on 54 inactive individuals with MS which affects generalizability to active individuals with MS. In fact, Dlugonski, Wojcicki, McAuley, and Motl recognize these limitations as they note it would be beneficial for future studies to compare both sedentary and active individuals with MS and to examine the extent to which there is a relationship between the components of SCT and physical activity among participants who differ in levels of current physical activity and self-efficacy (Dlugonski, Wojcicki, McAuley, & Motl, 2011).

The present study would serve to build upon the previous study by including a larger sample composed of both sedentary and active individuals with MS and providing information regarding a variety of contextual factors. These factors are educational level, specific employment information, and any secondary health issues participants are currently facing. Most importantly, the present study will specifically examine how disability interacts with self-efficacy.

Purpose of the Present Study. We know MS is a debilitating disease with four primary symptoms: fatigue, pain, mobility impairment, and depression. Research shows that physical activity effectively reduces such symptoms, and that SCT is a theory backed by empirical data used for health promotion. The purpose of this study is to extend previous findings by examining how various SCT concepts relate to physical health, mental health, stage of change for exercise, and action planning and coping planning for exercise so as to understand which concepts may be most important to consider when designing health promoting interventions that encourage physical activity.

CHAPTER THREE

Method

Participants

The current sample was comprised of two-hundred and fourteen individuals with self-reported MS recruited from the National Multiple Sclerosis Society (NMSS) and the neurology clinic of a university teaching hospital in the Midwest. Participants were provided the online anonymous survey link from a research flyer on the NMSS website. Inclusion criteria: the person must be diagnosed with MS, 18–65 years old, and living in the community. Ages of the participants ranged from 19 to 64 years, with a mean of 46.97 years (*SD* = 9.92). Most of the participants were women (*n* = 185, 86.4%), married (*n* = 150, 70.1%), and white (*n* = 169, 79%). Participants in the current study were highly educated with 34.1% having some college education (n = 72), 34.1% (n = 72) graduated from college, and 21.5% (n = 46) having completed graduate school education. About 36% of the participants had been retired due to MS, 35.5% were employed full time, and 12.6% were unemployed. Sixty-five (30.4%) participants were professionals; 18 were managers (8.4%); and 36 (16.8%) were in clerical or sales. One-hundred and fifty-three (71.5%) of the participants reported being treated for secondary health problems (e.g., overweight, high blood pressure, and diabetes).

Participant Recruitment and Eligibility. NMSS was contacted to elicit their support for this research project. Participants were recruited from several state chapters of the NMSS, through a survey link on the "Researchers Need You" section of the NMSS website. Additional participants were recruited from a neurology clinic at a university teaching hospital in the Midwest. Participants who volunteered to participate in the project were given a link to

complete the research packet developed by the first author on the *surveymonkey.com* website. Participants also received a $10 gift card as a token of appreciation for participating in the study.

Instruments

Nine measures were utilized in this study encapsulating demographic, SCT concepts, and disability and health domains.

Demographics. Participant demographic data relevant to this study were gathered from self-reports and include age, gender, ethnicity, marital status, years since onset of MS, secondary health issues, education level, vocational status, occupation, area of residence, current and past rehabilitation services received, source of income, total income, access to physical exercise in community, and changes in health practice since onset of MS.

Ethnicity has been divided into six categories: European American, Native American, Latino American, African American, Asian American and Other. “Other” represents individuals who identified themselves with a different ethnicity than one of the five provided.

SCT Concepts. The following measures were used to assess SCT concepts: Action Self-Efficacy Scale-Physical Exercise (ASES-PE), Outcome Expectancy Scale-Physical Exercise (OES-PE), Health/Safety Risk Perceptions Scale (HRPS), Health/Safety Expected Benefits Scale (HEBS), Barriers to Health Promoting Activities for Disabled Persons Scale (BHADP), the Action Planning and Coping planning Scale-Physical Exercise (APCPS-PE), the Physical Activity Stages of Change Instrument (PASC).

Disability and Health. The following measures were used to assess disability and health: Minimal Record of Disability (MRD) and the MOS Short form Health Survey (SF-12v2).

SCT Concepts. *Action Self-Efficacy Scale-Physical Exercise* (ASES-PE). The ASES was developed by Renner and Schwarzer (2005) to operationalize the concept of health action

self-efficacy with four subscales, namely, nutrition self-efficacy, physical exercise self-efficacy, alcohol reduction self-efficacy, and smoking cessation self-efficacy subscales. The two-item ASES-PE subscale was used in this study (e.g., “I can manage to carry out my exercise intentions, even when I have worries and problems.”). ASES items are rated using a 4-point Likert type rating scale from 1 (very uncertain) to 4 (very certain). The internal consistency reliability coefficient (Cronbach’s alpha) for the PE scale was reported to be .79 by Renner and Schwarzer and .87 for the present study (Chiu, Lynch, Chan, & Berven, 2011).

Outcome Expectancy Scale-Physical Exercise (OES-PE). The OES was developed by Renner and Schwarzer (2005) to operationalize the concept of health outcome expectancies. It is composed of 12 items and four subscales (i.e., nutrition, physical exercise, alcohol reduction, and smoking cessation outcome expectancy subscales). The OES-PE scale was used in this study (e.g., “If I exercise regularly, my cholesterol level and blood pressure will improve.”). OES items are rated using a 4-point Likert type rating scale from 1 (not at all true) to 4 (exactly true). The internal consistency reliability coefficient (Cronbach’s alpha) for the PE scale was reported to be .81 by Renner and Schwarzer and .83 for the present study (Chiu, Lynch, Chan, & Berven, 2011). In both the ASES-PE and OES, wording was based on Bandura’s recommendations to best operationalize health-action self-efficacy, and health outcome expectancies.

Health/Safety Risk Perceptions Scale (HRPS). The HRPS was developed by Weber, Blais, and Betz (2002) to operationalize the likelihood that people would engage in risky and harmful health behaviors, along with the perception of the magnitude of the risks related to these risky health activities. The HRPS is composed of 6 items (e.g., “Not exercising regularly”, “walking briskly for 30 minutes at least 3 times a week)”. HRPS items are rated on a 5-point Likert type scale from 1 (*not at all risky*) to 5 (*extremely risky*). The total score can range from 6

to 30. The internal consistency reliability coefficient (Cronbach's alpha) for the HRPS was reported to be .81 by Weber et al. and .69 for the present study (Chiu, Lynch, Chan, & Berven, 2011).

Health/Safety Expected Benefits Scale (HEBS). The HEBS was also developed by Weber et al. (2002) to operationalize the perception of the benefits of engaging in positive health activities. It is composed of 6 items (e.g., "Not exercising regularly", "walking briskly for 30 minutes at least 3 times a week)". HEBS items are rated on a 5-point Likert type scale from 1 (*no benefits at all*) to 5 (*great benefits*). The total score ranges from 6 to 30. The internal consistency reliability coefficient (Cronbach's alpha) for HEBS was reported to be .82 by Weber et al. and .50 for the present study (Chiu, Lynch, Chan, & Berven, 2011).

Barriers to Health Promoting Activities for Disabled Persons Scale (BHADP). The BHADP was developed by Becker, Stuifbergen, and Sands (1991) to measure perceptions of barriers to health promotion activities. It is composed of 18 items and three subscales: (a) intrapersonal barriers (e.g., "too tired"), (b) interpersonal (e.g., "other responsibilities"), and (c) environmental barriers (e.g., "lack of transportation"). Items are rated using a 4-point Likert-type scale from 1 (never) to 4 (routinely). The total score ranges from 18 to 72. A high score means greater perceived barriers. The internal consistency reliability coefficient (Cronbach's alpha) for BHADP was reported to be .82 by Becker et al. and it was .85 for the present study (Chiu, Lynch, Chan, & Berven, 2011).

Action Planning and Coping Planning Scale-Physical Exercise (APCPS-PE). The APCPS-PE was developed by Sniehotta, Schwarzer, Scholz, and Schuz (2005) to measure the metacognition of action planning and coping planning for exercise. It is composed of 9 items and two subscales: (a) action planning subscale, 5 items (e.g., "I already have concrete plans for

when to exercise"), and (b) coping planning, 4 items (e.g., "I already have concrete plans what to do if something intervenes"). Items are rated on a 4-point Likert type scale from 1 (not at all true) to 4 (exactly true). The total score for the action planning subscale can range from 5 to 20 and the total score for the coping planning subscale can range from 4 to 16. Sniehotta et al. reported that the internal consistency reliability coefficients (Cronbach's alpha) for action planning and coping planning were 0.92, and 0.90 respectively and the reliability coefficients are .91 and .97 for the present study (Chiu, Lynch, Chan, & Berven, 2011).

Physical Activity Stages of Change Instrument (PASC). The PASC was developed by Nigg et al. (2005) to operationalize the concept of readiness to engage in physical activity. In the present study, the PASC was used as an outcome measure to assess the degree of engagement in physical activity. The PASC is composed of 4 items (e.g., "Do you currently engage in regular physical activity?"). Items are rated on a dichotomous "yes" or "no" format. 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 are considered 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. The higher stages, the more physical activity engaged.

Disability and Health. *Minimal Record of Disability* (MRD). The MRD was developed by the International Federation of Multiple Sclerosis Societies (1984) to operationalize the construct severity of MS by evaluating MS symptoms and performance of activity of daily living. It is composed of 23 items and two subscales: (a) the *Incapacity Status Scale* (ISS), 16 items (e.g., "stair climbing," "speech and hearing," and "mood and thought"), has a focus on

functional disability in activities of daily living (ADL); and (b) and the *Environmental Status Scale* (ESS), 7 items (e.g., “work status,” " personal residence or home,” and “transportation”), has an emphasis on social impairment resulting from the illness. ISS items are rated on a 5-point Likert type scale from 0 (no disability) to 4 (most disability). ESS items are rated on a 6-point Likert type scale ranging from 0 (no disability) to 5 (totally lost). The ISS with its focus on ADL was used to operationally define MS severity in the current study. Moderate intraclass correlation coefficients (ICC) were found between the MRD and the *Kurtzke Functional System* (KFS), ranging from .26 with the KFS sensory scale to .69 with the KFS pyramidal function scale (Solari et al., 1993). Also, high concordance (ICC= .84) was found between the MRD and the *Expanded Disability Status Scale* (EDSS) (Chiu, Lynch, Chan, & Berven, 2011). Cronbach’s alpha coefficients for the ISS and ESS in the present study were computed to be .90, and .90 respectively (Chiu, Lynch, Chan, & Berven, 2011).

MOS Short form Health Survey (SF-12v2). The SF-12v2 was developed by Ware, Kosinski, and Keller (1996) to operationalize the concept of health-related quality of life. It is composed of 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, i.e., “during the past 4 weeks, how much did pain interfere with your normal work [including both work outside the home and housework]?”); (d) general health (1 item, i.e., “in general, would you say your health is excellent/ very good/good/fair/poor?”); (e) vitality (1 item: “did you have a lot of energy?”); (f) social functioning (1 item: “during the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities [like visiting with friends, relatives, etc.]?”); (g) role limitations due to

emotional problems (2 items, e.g., “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]?”); and (h) mental health (2 items, e.g., “have you felt calm and peaceful?”). Items are rated on a 5-point Likert type scale of 1 (excellent), 2 (very good), 3 (good), 4 (fair), and 5 (poor) for items #1,#4, #5, #6, #7, #8, #9, #10, #11, and #12, and a 3-point Likert type scale of 1 (yes, limited a lot), 2 (yes, limited a little), and 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 are standardized on a general population sample as well (M=50, SD=10). Normative data of the general population allows for the derivation of T scores. The first four subscales have the highest load on the PCS and the last four subscales have the highest load on the MCS. Test-retest reliability over a 2-week interval was estimated at 0.89 for the SF-12 PCS and 0.76 for the SF-12 MCS (Chiu, Lynch, Chan, & Berven, 2011). Cronbach’s alpha for the SF-12 on the PCS in the present study was 0.87, with 0.82 for the MCS (Chiu, Lynch, Chan, & Berven, 2011).

Data Analysis

A hierarchical regression was used to examine associations between various domains (see below) and a set of social cognitive concepts (self-efficacy, knowledge of health and risk benefits, and outcome expectancy). The first analysis examined the associations between action planning as a proxy of goal setting in Bandura’s social cognitive framework the social cognitive concepts, and barriers as well as the interaction between disability and self- efficacy. The second analysis examined the associations between physical health, the social cognitive concepts, goal setting (i.e., action planning) and barriers as well as the interaction between disability and self-efficacy. The third analysis examined the associations between mental health, social cognitive

concepts, goal setting (i.e., action planning), barriers, and physical activity behavior as well as the interaction between disability and self-efficacy. The fourth analysis examined the associations between stage of change, the social cognitive concepts, goal setting (i.e., action planning), barriers, and physical activity behaviors as well as the interaction between disability and self-efficacy. In summary, we examined the following models, controlling for contextual factors, including age, education, employment, and current chronic health problems:

Based on the currently existing body of literature, the hypothesis is that the outcome variables action planning, physical health, mental health, and stage of change will be explained by contextual factors, SCT concepts, and the interaction between severity of disability and action self-efficacy.

Finalized regression:

(1) The outcome variable is "Action Planning"

Action Planning = [Contextual Factors] + [Severity of Disability] + [Barriers to Health Promotion] + [Action Self-Efficacy, Outcome Expectancy, Risk Perception] + [Severity of Disability*Action Self-Efficacy]

(2) The outcome variable is "Physical Health (from SF-12)"

Physical Health = [Contextual Factors] + [Severity of Disability] + [Barriers to Health Promotion] + [Action Self-Efficacy, Outcome Expectancy, Risk Perception] + [Severity of Disability*Action Self-Efficacy] + Action Planning

(3) The outcome variable is "Mental Health (from SF-12)"

Mental Health = [Contextual Factors] + [Severity of Disability] + [Barriers to Health Promotion] + [Action Self-Efficacy, Outcome Expectancy, Risk Perception] + [Severity of Disability*Action Self-Efficacy] + Action Planning

(4) The outcome variable is "Stage of Change"

Stage of Change = [Contextual Factors] + [Severity of Disability] + [Barriers to Health Promotion] + [Action Self-Efficacy, Outcome Expectancy, Risk Perception] + [Severity of Disability*Action Self-Efficacy].

CHAPTER FOUR

Results

Demographic Background (N = 214)

Two-hundred and fourteen participants were recruited in the present study. Of the 214 participants, the majority were women, average age nearly 48, who have lived with MS for an average of 10 years, were highly educated and financially comfortable in regards to annual household income (refer to Table 1 for all results of Demographic Data).

Measurement Results

To summarize, results showed that participants reported high action self-efficacy for exercise, were in the first three stages of change for exercise (precontemplation, contemplation, preparation), demonstrated limited disability, and reported lower physical health than mental health (refer to Table 2 for all measurement results).

Hierarchical regression analysis was conducted with four dependent variables: exercise action planning and coping planning, stage of change, physical health, and mental health. When exercise action planning and coping planning was the dependent variable (and a proxy of goal setting in Bandura's SCT framework), five sets of predictors were entered in sequential steps: (1) contextual factors (household income, age, and education); (2) severity of disability; (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; and (5) interaction between severity of disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 3. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized beta coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 4.

In the first step of the regression analysis, contextual factors (household income, age, and education) were entered. This set of variables accounted for a significant amount of variance in action planning and coping planning for exercise, $R = .21$, $R^2 = .04$, $F(3, 202)$, $p = .03$. Examining the standardized regression coefficients, household income was found to significantly contribute to the change in variance in exercise action planning and coping planning, $\beta = .17$, $p < .05$. Severity of disability was entered at the second step of the regression. The addition of this variable did not account for a significant increase in variance of exercise action planning and coping scores beyond that explained by the previous set of predictors, $R = .22$, $R^2 = .05$, $\Delta R^2 = .01$, F (1, 201), $p = .26$., *n.s.*

Perceived barriers was entered in the third step of the regression analysis. This variable accounted for a significant amount of variance in exercise action planning and coping planning, $R = .40$, $R^2 = .16$, $\Delta R^2 = .11$, F (1, 200), $p < .001$. Perceived barriers to health promotion was found to contribute significantly to the change in variance in exercise action planning and coping planning scores, $\beta = -.41$, $p < .001$, indicating that increased perceived barriers to health promotion was associated with lower scores of exercise action planning and coping planning.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables also accounted for a significant amount of variance in exercise action planning and coping planning, $R = .67$, $R^2 = .45$, $\Delta R^2 = .29$, F (3, 197), $p < .001$. Risk perception was found to be a significant contributor to the change in variance of exercise action planning and coping scores, $\beta = .14$, $p < .05$. Action self-efficacy was also found to be a significant contributor to change in variance in action planning and coping scores, $\beta = .45$, $p < .001$. Additionally, outcome expectancy was also found to contribute significantly to the change in variance in exercise action planning and coping planning scores, $\beta = .19$, $p < .01$.

In the final step, the interaction between severity of disability and action self-efficacy was entered into the regression analysis. The addition of the interaction between these two variables did not account for a significant amount of additional variance in exercise action planning and coping planning, $R = .67$, $R^2 = .45$, $\Delta R^2 = .00$, F (1, 196), $p = .78$, *n.s.* The interaction between severity of disability and action self-efficacy was not found to be a significant contributor to the variance in exercise action planning and coping planning, $\beta = -.02$, $p = .78$. The final regression model accounted for 45% of the variance in exercise action planning and coping planning. According to Cohen's standards for the behavioral sciences research, this is considered a large effect size (Cohen, 1992). In the final model, risk perception remained a significant contributor to the variance in physical activity/exercise participation, $\beta = .14$, $p < .05$. Outcome expectancy also remained a significant predictor of physical activity/exercise participation, $\beta = .19$, $p < .01$. Lastly, action self-efficacy also remained a significant predictor of physical activity/exercise participation, $\beta = .45$, $p < .001$. Controlling for all other factors, risk perception, outcome expectancy, and action self-efficacy were found to be significant predictors of exercise action planning and coping planning for persons with MS. Risk perception, outcome expectancy, and action self-efficacy were positively associated with exercise action planning and coping in persons with MS. A secondary analysis was conducted to identify a parsimonious model. The dependent variable, exercise action planning and coping planning, remained the same, however, some variables/steps were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 5. Results of the hierarchical regression analysis, including values of change

in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 6.

In the second model, stage of change for exercise was the dependent variable and six sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of disability; (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; (5) exercise action planning and coping planning; and (6) interaction between severity of disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 7. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 8.

In the first step of the regression analysis, contextual factors (household income, age, and education) were entered. This set of variables did account for a significant amount of variance in stage of change for exercise, $R = .29$, $R^2 = .09$, $\Delta R^2 = .09$, F (3, 202), $p < .001$. Examining the standardized regression coefficients, household income was found to significantly contribute to the change in variance in stage of change for exercise with $\beta = .23$, $p < .01$.

Severity of disability was entered at the second step of the regression. The addition of this variable accounted for a significant increase in variance of stage of change, $R = .33$, $R^2 = .11$, $\Delta R^2 = .02$, F (1, 201), $p < .05$. Severity of disability was found to contribute significantly to the change in variance in stage of change for exercise with $\beta = -.17$, $p < .05$.

Perceived barriers was entered in the third step of the regression analysis. This variable accounted for a significant amount of variance in stage of change for exercise, $R = .36$, $R^2 = .13$, $\Delta R^2 = .02$, F (1, 200), $p < .05$. Perceived barriers to health promotion was found to contribute

significantly to the change in variance in stage of change for exercise, β = -.17, $p < .05$, indicating that increased perceived barriers to health promotion was associated with lower scores of stage of change for exercise.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables also accounted for a significant amount of variance in stage of change for exercise, $R = .50$, $R^2 = .25$, $\Delta R^2 = .12$, F (3, 197), $p < .001$. Risk perception was found to be a significant contributor to the change in variance, $\beta = .16$, $p < .05$. Action self-efficacy was also found to be a significant contributor to change in variance in stage of change scores for exercise, $\beta = .17$, $p < .05$. Additionally, outcome expectancy was also found to contribute significantly to the change in variance in stage of change scores for exercise, β = .19, $p < .05$.

In the fifth step, exercise action planning and coping planning was entered into the regression analysis. The addition of this variable accounted for a significant amount of variance in stage of change for exercise, $R = .54$, $R^2 = .29$, $\Delta R^2 = .04$, F (1, 196), $p < .01$. Exercise action planning and coping planning was found to be a significant contributor to change in variance in stage of change for exercise, $\beta = .27$, $p < .01$.

In the final step, the interaction between severity of disability and action self-efficacy was entered into the regression analysis. The addition of the interaction between these two variables did not account for a significant amount of additional variance in stage of change for exercise, $R = .54$, $R^2 = .29$, $\Delta R^2 = .00$, F (1, 195), $p = .93$, *n.s.* The interaction between severity of disability and action self-efficacy was not found to be a significant contributor to the variance in stage of change for exercise, β = -.01, $p = .93$. The final regression model accounted for 29% of the variance in exercise stage of change. According to Cohen's standards for the behavioral sciences

research, this is considered a large effect size (Cohen, 1992). In the final model, exercise action planning and coping planning remained a significant contributor to the variance in physical activity/exercise participation, $\beta = .27$, $p < .01$. Controlling for all other factors, exercise action planning and coping planning was found to be a significant predictor of stage of change for exercise for persons with MS. Exercise action planning and coping planning was positively associated with stage of change for exercise in persons with MS. A secondary analysis was conducted to identify a parsimonious model. The dependent variable, stage of change for exercise, remained the same, however, some variables/steps were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 9. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 10.

In the third model, physical health was the dependent variable and seven sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of disability; (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; (5) exercise action planning and coping planning; (6) stage of change for exercise; and (7) interaction between severity of disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 11. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 12.

In the first step of this hierarchical regression analysis with physical health as the dependent variable, household income, age, and education were entered as contextual factors. This set of variables did account for a significant amount of variance in physical health scores, $R = .29$, $R^2 = .08$, $\Delta R^2 = .08$, F (3, 202), $p < .01$. Age was found to contribute significantly to the change in variance in physical health, $\beta = -.28$, $p < .001$.

Severity of disability was entered at the second step of the regression. The addition of this variable did account for a significant increase in variance of physical health beyond that explained by the previous set of predictors, $R = .36$, $R^2 = .13$, $\Delta R^2 = .04$, F (1, 201), $p < .01$. Severity of disability was found to contribute significantly to the change in variance in physical health, $\beta = -.23$, $p < .01$.

Perceived barriers was entered in the third step of the regression analysis. This variable did not account for a significant amount of variance in physical health, $R = .37$, $R^2 = .13$, $\Delta R^2 = .01$, F (1, 200), $p = .17$, *n.s.*

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables accounted for a significant amount of variance in physical health, $R = .46$, $R^2 = .21$, $\Delta R^2 = .08$, F (3, 197), $p < .001$. Outcome expectancy was found to be a significant contributor to the change in variance, $\beta = .29$, $p < .001$. Action self-efficacy was also found to be a significant contributor to change in variance in physical health, $\beta = -.16$, $p < .05$.

In the fifth step, exercise action planning and coping planning was entered into the regression analysis. The addition of this variable did not account for a significant amount of variance in physical health, $R = .46$, $R^2 = .21$, $\Delta R^2 = .00$, F (1, 196), $p = .85$, *n.s.*

In the sixth step, stage of change for exercise was entered into the regression analysis. The addition of this variable did not account for a significant amount of variance in physical health, $R = .46$, $R^2 = .21$, $\Delta R^2 = .00$, F (1, 195), $p = .96$, *n.s*.

In the final step, the interaction between severity of disability and action self-efficacy was entered into the regression analysis. The addition of the interaction between these two variables did not account for a significant amount of additional variance in physical health, $R = .47$, $R^2 = .22$, $\Delta R^2 = .01$, F (1, 194), $p = .07$, *n.s.* The interaction between severity of disability and action self-efficacy was not found to be a significant contributor to the variance in stage of change for physical health, $\beta = -.12$, $p = .07$. The final regression model accounted for 22% of the variance in physical health. According to Cohen's standards for the behavioral sciences research, this is considered a medium to large effect size (Cohen, 1992). In the final model, age remained a significant contributor to the variance in physical health, $\beta = -.19$, $p < .01$. Severity of disability also remained to contribute significantly to the change in variance in physical health, $\beta = -.27$, $p < .01$, as did outcome expectancy, $\beta = .29$, $p < .001$. Controlling for all other factors, age, severity of disability, and outcome expectancy were found to be significant predictors of physical health for persons with MS. Outcome expectancy was positively associated with physical health in persons with MS, while age and severity of disability were negatively associated with physical health.

A secondary analysis was conducted to identify a parsimonious model. The dependent variable, physical health, remained the same; however, some variables were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 13. Results of the hierarchical

regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 14.

In the fourth model, mental health was the dependent variable and seven sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of disability; (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; (5) exercise action planning and coping planning; (6) stage of change for exercise; and (7) interaction between severity of disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 15. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 16.

In the first step of this hierarchical regression analysis with mental health as the dependent variable, household income, age, and education were entered as contextual factors. This set of variables accounted for a significant amount of variance in mental health, $R = .24$, $R^2 = .06$, $\Delta R^2 = .06$, F (3, 202), $p < .01$. Household income was found to contribute significantly to the change in variance in mental health, $\beta = .19$, $p < .01$.

Severity of disability was entered at the second step of the regression. The addition of this variable accounted for a significant increase in variance of mental health, $R = .30$, $R^2 = .09$, $\Delta R^2 = .04$, F (1, 201), $p < .01$. Severity of disability was found to contribute significantly to the change in variance in mental health, $\beta = -.21$, $p < .01$.

Perceived barriers was entered in the third step of the regression analysis. This variable accounted for a significant amount of variance in mental health, $R = .34$, $R^2 = .11$, $\Delta R^2 = .02$, F (1,

200), $p < .05$. Perceived barriers contributed significantly to the change in variance in mental health, $\beta = -.19$, $p < .05$.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables accounted for a significant amount of variance in mental health, $R = .43$, $R^2 = .19$, $\Delta R^2 = .07$, F (3, 197), $p < .01$. Outcome expectancy was found to be a significant contributor to the change in variance of mental health, $\beta = -.27$, $p < .001$.

In the fifth step, exercise action planning and coping planning was entered into the regression analysis. The addition of this variable did not account for a significant amount of variance in mental health, $R = .45$, $R^2 = .20$, $\Delta R^2 = .02$, F (1, 196), $p = .06$, *n.s.*

In the sixth step, stage of change for exercise was entered into the regression analysis. The addition of this variable did not account for a significant amount of variance in mental health, $R = .45$, $R^2 = .20$, $\Delta R^2 = .00$, F (1, 195), $p = .69$, *n.s.*

In the final step, the interaction between severity of disability and action self-efficacy was entered into the regression analysis. The addition of the interaction between these two variables accounted for a significant amount of additional variance in mental health, $R = .49$, $R^2 = .24$, $\Delta R^2 = .04$, F (1, 194), $p < .01$. The interaction between severity of disability and action self-efficacy was found to be a significant contributor to the variance in stage of change for mental health, $\beta = .20$, $p < .01$. The final regression model accounted for 24% of the variance in mental health. According to Cohen's standards for the behavioral sciences research, this is considered a medium to large effect size (Cohen, 1992). In the final model, age was a significant contributor to the variance in mental health, $\beta = .17$, $p < .05$. Barriers to health contributed significantly to the change in variance in mental health, $\beta = -.22$, $p < .05$, as did action self-efficacy, $\beta = .21$, $p < .05$; outcome expectancy, $\beta = -.25$, $p < .01$; and the interaction between severity of disability and

action self-efficacy, $\beta = .20$, $p < .001$. Controlling for all other factors, age, severity of disability, outcome expectancy, action self-efficacy, and barriers to health promotion were found to be significant predictors of mental health for persons with MS. Age, action self-efficacy, and the interaction between severity of disability were positively associated with mental health for persons with MS. Barriers to health and outcome expectancy were negatively associated with mental health for persons with MS.

A secondary analysis was conducted to identify a parsimonious model. The dependent variable, mental health, remained the same, however, some variables/steps were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 17. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 18.

After reviewing the data and results, if disability itself has a slim chance to be improved by physical activity, and physical activity would be good to improve MS symptoms and the following secondary conditions, and further, health management is good for quality of life and well-being; then it is reasonable to examine if functional disability (e.g., work, social activity, role performance) could be improved by participating in physical activity, particularly for MS patients who have very mild physical dysfunction.

The current sample data showed that participants have very mild disability in terms of mobility and basic ADL, which is measured by MRD1. However, their social and environmental function has been influenced more than their incapacity disability. It is significantly different

between MRD-subtest 2 and MRD-subtest 1, $t_{(213)} = 3.73$, $p = .000$. Additionally, there is a significant difference between SF-12 Physical Health and Mental Health, $t_{(213)} = -12.94$, $p = .000$. Therefore we conducted a further analysis to explore how social/environmental disability explains the following dependent variables in regression models.

In the fifth model, exercise action planning and coping planning was the dependent variable and five sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of social/environmental disability (using MRD-subtest 2); (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; and (5) interaction between severity of social/environmental disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 19. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 20.

In the first step of this hierarchical regression analysis with exercise action planning and coping planning as the dependent variable, household income, age, and education were entered as contextual factors. This set of variables accounted for a significant amount of variance in exercise action planning and coping planning, $R = .21$, $R^2 = .04$, $\Delta R^2 = .04$, F (3, 202), $p < .05$. Household income was found to contribute significantly to the change in variance in exercise action planning and coping planning scores, $\beta = .17$, $p < .05$.

Severity of disability was entered at the second step of the regression. The addition of this variable did not account for a significant increase in variance of exercise action planning and coping planning, $R = .22$, $R^2 = .05$, $\Delta R^2 = .01$, F (1, 201), $p = .30$, *n.s.*

Perceived barriers were entered in the third step of the regression analysis. This variable accounted for a significant amount of variance in exercise action planning and coping planning, $R = .40$, $R^2 = .16$, $\Delta R^2 = .11$, F (1, 200), $p < .001$. Perceived barriers contributed significantly to the change in variance in exercise action planning and coping planning, $\beta = -.40$, $p < .001$.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables accounted for a significant amount of variance in exercise action planning and coping planning, $R = .67$, $R^2 = .45$, $\Delta R^2 = .29$, F (3, 197), $p < .001$. Action self-efficacy was found to be a significant contributor to the change in variance, $\beta = .45$, $p < .001$. Additionally, outcome expectancy was also found to be a significant contributor to the change in variance, of exercise action planning and coping planning, $\beta = .20$, $p < .01$, as was risk perception, $\beta = .14$, $p < .05$.

In the final step, the interaction between social/environmental disability and action self-efficacy was entered into the regression analysis. The addition of this variable did not account for a significant amount of variance in exercise action planning and coping planning, $R = .67$, $R^2 = .43$, $\Delta R^2 = .00$, F (1, 196), $p = .74$, *n.s.*

The final regression model accounted for 45% of the variance in exercise action planning and coping planning. According to Cohen's standards for the behavioral sciences research, this is considered a large effect size (Cohen, 1992). In the final model, action self-efficacy was a significant contributor to the variance in exercise action planning and coping planning, $\beta = .47$, $p < .001$. Outcome expectancy contributed significantly to the change in variance in exercise action planning and coping planning, $\beta = .20$, $p < .01$, as did risk perception, $\beta = .14$, $p < .05$. Controlling for all other factors, action self-efficacy, outcome expectancy, and risk perception were found to be significant predictors of exercise action planning and coping planning for

persons with MS. Action self-efficacy, outcome expectancy, and risk perception were positively associated with exercise action planning and coping planning for persons with MS.

A secondary analysis was conducted to identify a parsimonious model. The dependent variable, exercise action planning and coping planning, remained the same; however, some variables/steps were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 21. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 22.

In the sixth model, stage of change for exercise was the dependent variable and six sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of social/environmental disability (using MRD-subtest 2); (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; (5) exercise action planning and coping planning; and (6) the interaction between severity of social/environmental disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 23. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 24.

In the first step of this hierarchical regression analysis with stage of change for exercise as the dependent variable, household income, age, and education were entered as contextual factors. This set of variables accounted for a significant amount of variance in stage of change

for exercise, $R = .29$, $R^2 = .09$, $\Delta R^2 = .09$, F (3, 202), $p < .001$. Household income was found to contribute significantly to the change in variance in stage of change for exercise, $\beta = .23$, $p < .01$.

Severity of disability was entered at the second step of the regression. The addition of this variable did not account for a significant increase in variance of stage of change for exercise beyond that explained by the previous set of predictors, $R = .31$, $R^2 = .10$, $\Delta R^2 = .01$, F (1, 201), $p = .15$, *n.s*.

Perceived barriers were entered in the third step of the regression analysis. This variable accounted for a significant amount of variance in stage of change for exercise, $R = .35$, $R^2 = .13$, $\Delta R^2 = .03$, F (1, 200), $p < .05$. Perceived barriers contributed significantly to the change in variance in stage of change for exercise, $\beta = -.21$, $p < .05$.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables accounted for a significant amount of variance in stage of change for exercise beyond that explained by previous sets of predictors, $R = .50$, $R^2 = .25$, $\Delta R^2 = .12$, F (3, 197), $p < .001$. Action self-efficacy was found to be a significant contributor to the change in variance of stage of change for exercise, $\beta = .17$, $p < .05$. Additionally, outcome expectancy was also found to be a significant contributor to the change in variance of stage of change for exercise, $\beta = .20$, $p < .01$, as was risk perception, $\beta = .15$, $p < .05$.

Exercise action planning and coping planning was entered in the fifth step, and accounted for a significant amount of variance in stage of change for exercise scores, $R = .53$, $R^2 = .28$, $\Delta R^2 = .04$, F (1, 196), $p < .01$. Exercise action planning and coping planning was found to be a significant contributor to the change in variance of stage of change for exercise, $\beta = .26$, $p < .01$.

In the final step, the interaction between social/environmental disability and action self-efficacy was entered into the regression analysis. The addition of this variable did not account

for a significant amount of variance in stage of change for exercise, $R = .53$, $R^2 = .28$, $\Delta R^2 = .00$, F (1, 195), $p = .92$, *n.s*.

The final regression model accounted for 28% of the variance in stage of change for exercise. According to Cohen's standards for the behavioral sciences research, this is considered a large effect size (Cohen, 1992). In the final model, exercise action planning and coping planning was a significant contributor to the variance in stage of change for exercise, $\beta = .26$, $p < .01$. Controlling for all other factors, exercise action planning and coping planning was found to be a significant predictor of stage of change for exercise for persons with MS, and was positively associated with stage of change for exercise for persons with MS.

A secondary analysis was conducted to identify a parsimonious model. The dependent variable, stage of change for exercise, remained the same, however, some variables were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 25. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 26.

In the seventh model, physical health was the dependent variable and seven sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of social/environmental disability (using MRD-subtest 2); (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; (5) exercise action planning and coping planning; (6) stage of change for exercise; and (7) the interaction between severity of social/environmental disability and action self-efficacy. The correlations

among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 27. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 28.

In the first step of this hierarchical regression analysis with physical health as the dependent variable, household income, age, and education were entered as contextual factors. This set of variables accounted for a significant amount of variance in physical health, $R = .29$, $R^2 = .08$, $\Delta R^2 = .08$, F (3, 202), $p < .01$. Age was found to contribute significantly to the change in variance in physical health, $\beta = -.28$, $p < .001$.

Severity of disability was entered at the second step of the regression. The addition of this variable did account for a significant increase in variance of physical health, $R = .38$, $R^2 = .14$, $\Delta R^2 = .06$, F (1, 201), $p < .001$. Severity of disability was found to contribute significantly to the change in variance in physical health, $\beta = -.28$, $p < .001$.

Perceived barriers were entered in the third step of the regression analysis. This variable did not account for a significant amount of variance in physical health, $R = .39$, $R^2 = .15$, $\Delta R^2 = .01$, F (1, 200), $p = .14$.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables accounted for a significant amount of variance in physical health beyond that explained by previous sets of predictors, $R = .47$, $R^2 = .22$, $\Delta R^2 = .07$, F (3, 197), $p < .01$. Action self-efficacy was found to be a significant contributor to the change in variance of physical health, $\beta = -.16$, $p < .05$. Additionally, outcome expectancy was also found to be a significant contributor to the change in variance of physical health, $\beta = .27$, $p < .01$.

Exercise action planning and coping planning was entered in the fifth step, and did not account for a significant amount of variance in physical health, $R = .47$, $R^2 = .22$, $\Delta R^2 = .00$, F (1, 196), $p = .77$, *n.s.*

Stage of change for exercise was entered in the sixth step, and did not account for a significant amount of variance in physical health, $R = .47$, $R^2 = .22$, $\Delta R^2 = .00$, F (1, 195), $p = .83$, *n.s.*

In the final step, the interaction between social/environmental disability and action self-efficacy was entered into the regression analysis. The addition of this variable did not account for a significant amount of variance in physical health, $R = .48$, $R^2 = .23$, $\Delta R^2 = .01$, F (1, 194), $p = .15$, *n.s.*

The final regression model accounted for 23% of the variance in physical health. According to Cohen's standards for the behavioral sciences research, this is considered a medium to large effect size (Cohen, 1992). In the final model, age was a significant contributor to the variance in physical health, $\beta = -.20$, $p < .01$. Additionally, outcome expectancy was also found to be a significant contributor to the variance in physical health, $\beta = .26$, $p < .01$. Controlling for all other factors, age and outcome expectancy were found to be significant predictors of physical health for persons with MS. Age was negatively associated with physical health for persons with MS, while outcome expectancy was positively associated with physical health for persons with MS.

A secondary analysis was conducted to identify a parsimonious model. The dependent variable, stage of change for exercise, remained the same; however, some variables/steps were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to

large and the correlation matrix for all variables is presented in Table 29. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 30.

In the eighth model, mental health was the dependent variable and seven sets of predictors were entered in sequential steps (1) contextual factors (household income, age, and education); (2) severity of social/environmental disability (using MRD-subtest 2); (3) barriers to health promotion; (4) risk perception, action self-efficacy, outcome expectancy; (5) exercise action planning and coping planning; (6) stage of change for exercise; and (7) the interaction between severity of social/environmental disability and action self-efficacy. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 31. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 32.

In the first step of this hierarchical regression analysis with mental health as the dependent variable, household income, age, and education were entered as contextual factors. This set of variables accounted for a significant amount of variance in mental health, $R = .24$, $R^2 = .06$, $\Delta R^2 = .06$, F (3, 202), $p < .01$. Household income was found to contribute significantly to the change in variance in mental health, $\beta = .19$, $p < .01$.

Severity of disability was entered at the second step of the regression. The addition of this variable accounted for a significant increase in variance of mental health beyond that explained by the previous set of predictors, $R = .28$, $R^2 = .08$, $\Delta R^2 = .03$, F (1, 201), $p < .05$.

Severity of disability was found to contribute significantly to the change in variance in mental health, β = -.18, $p < .05$.

Perceived barriers were entered in the third step of the regression analysis. This variable also accounted for a significant amount of variance in mental health beyond that explained by the covariates entered in the first and second steps, $R = .33$, $R^2 = .11$, $\Delta R^2 = .03$, F (1, 200), $p < .05$. Severity of disability was found to contribute significantly to the change in variance in mental health, β = -.21, $p < .05$.

Risk perception, action self-efficacy, and outcome expectancy were entered in the fourth step of the regression analysis. These variables accounted for a significant amount of variance in mental health, $R = .43$, $R^2 = .18$, $\Delta R^2 = .07$, F (3, 197), $p < .01$. Outcome expectancy was found to be a significant contributor to the change in variance of mental health, β = -.28, $p < .001$.

Exercise action planning and coping planning was entered in the fifth step, and did not account for a significant amount of variance in mental health, $R = .44$, $R^2 = .20$, $\Delta R^2 = .01$, F (1, 196), $p = .06$, *n.s.* Stage of change for exercise was entered in the sixth step, and did not account for a significant amount of variance in mental health, $R = .45$, $R^2 = .20$, $\Delta R^2 = .00$, F (1, 195), $p = .59$, *n.s.*

In the final step, the interaction between social/environmental disability and action self-efficacy was entered into the regression analysis. The addition of this variable accounted for a significant amount of variance in mental health, $R = .47$, $R^2 = .22$, $\Delta R^2 = .02$, F (1, 194), $p <. 05$. The interaction between social/environmental disability and action self-efficacy was found to be a significant contributor to the change in variance, $\beta = .43$, $p < .05$.

The final regression model accounted for 22% of the variance in mental health. According to Cohen's standards for the behavioral sciences research, this is considered a

medium to large effect size (Cohen, 1992). In the final model, age was a significant contributor to the variance in mental health, $\beta = .17$, $p < .05$. Severity of disability was also found to be a significant contributor to the variance in mental health, $\beta = -.52$, $p < .05$. Similarly, barriers to health promotion contributed significantly to the variance in mental health, $\beta = -.25$, $p < .01$, as did outcome expectancy, $\beta = -.25$, $p < .01$, and the interaction between severity of disability and action self-efficacy, $\beta = .43$, $p < .05$.

Controlling for all other factors, age, severity of disability, barriers to health promotion, outcome expectancy, and the interaction between severity of disability and action self-efficacy were all found to be significant predictors of mental health for persons with MS. Age and the interaction between severity of disability and action self-efficacy were positively associated with mental health for persons with MS. Severity of disability, outcome expectancy, and barriers to health promotion were negatively associated with mental health for persons with MS.

A secondary analysis was conducted to identify a parsimonious model. The dependent variable, mental, remained the same, however, some variables/steps were removed that did not significantly account for variance as demonstrated in the previous model. The correlations among the dependent variable and the predictor variables ranged from small to large and the correlation matrix for all variables is presented in Table 33. Results of the hierarchical regression analysis, including values of change in R^2 (ΔR^2), along with standardized coefficients (β) for the predictor variables at most steps and in the final model are presented in Table 34.

CHAPTER FIVE

Discussion

The purpose of this study was to extend previous findings by examining how various SCT concepts relate to action planning and coping planning for exercise, stage of change for exercise, physical health, and mental health. This study found support for SCT concepts being related to outcomes such as physical health, mental health, stage of change for exercise, and action planning and coping planning for exercise.

The final analyses, used subjective self-report measures to explore the domains of action planning and coping planning, stage of change, physical health, and mental health as outcome variables with a new predictor variable (the interaction between severity of social/environmental disability and action self-efficacy) provide support for the use of Bandura's SCT concepts being related to the four outcome variables previously discussed.

When examining the first aim (action planning and coping planning), the final model accounted for 45% of the variance in action planning and coping planning for exercise. Barriers, risk perception, outcome expectancy, and action self-efficacy were the strongest predictors of action planning and coping planning for exercise. Risk perception, outcome expectancy, and self-efficacy are key concepts of Bandura's SCT, providing further support for this theory. This finding builds upon the prior literature as it further examines which particular variables may best be used to explain action planning and coping planning for persons with MS. Considering action self-efficacy is the greatest predictor of action planning and coping planning for exercise, future rehabilitation programs should utilize this information (see "Implications for Rehabilitation Counseling Practice" below) when designing intervention programs. Furthermore, this finding is consistent with prior literature adding support to the concept that

action self-efficacy is one of the most important constructs of Bandura's SCT for behavioral change (Bandura, 2004).

When examining the second aim, stage of change for exercise, the final model accounted for 28% of the variance in stage of change for exercise. Action planning and coping planning was identified as the strongest predictor of stage of change for exercise. One possible explanation is that planning is closely associated with behavioral intention, and ultimately behavior (Bandura, 2004). Considering that action planning and coping planning is a critical aspect for promoting health behavior, it is likely that people who create a plan of action (consisting of realistic goals) will be more comfortable adapting a new behavior. Additionally, imagining potential obstacles that might impede their behavioral change, and identifying ways to cope with potential challenges, likely increases the person's sense of confidence to move forward in engaging in a new behavior. The variable action planning and coping planning was found to enhance stage of change, which in turn predicted health-promoting behavior.

In essence, action planning and coping planning provides a thoughtful framework that may make behavioral change less overwhelming, and provide a sense of confidence in overcoming situations that may affect performance. Developing a plan to adopt a new behavior, as well as strategies to overcome potential obstacles, is an important part of transitioning from one stage of change (i.e. the stage "preparation") to the next (i.e. the stage "action"). As action planning and coping planning is a concept of Bandura's SCT, this finding provides further support for the theory and its application for health promotion. This finding also builds upon past studies as stage of change is influenced by action planning and coping planning for persons with MS. Considering we found that action planning and coping planning is the greatest predictor of stage of change for exercise, rehabilitation programs may work with patients to

address concerns and potential problems they foresee (increasing their pragmatic, feasible sense of action and coping planning) which would likely affect the patient's willingness to change and adopt a new behavior.

When examining the third aim, physical health, the final model accounted for 22% of the variance in physical health. Age, outcome expectancy, severity of disability, and action self-efficacy were significant individual predictors of physical health. The findings from this study revealed a negative correlation between action self-efficacy and physical health; which is inconsistent with earlier research that has established a significant and positive association between self-efficacy and physical activity ($\beta = 0.22$, $p < .01$), thereby improving physical health (Morris, McAuley, & Motl, 2008). One explanation for this difference is that this study included a unique subset of the MS population who were well-educated, affluent, reported greater access to services, and reported high action self-efficacy. Bandura notes that socioeconomic status and education affect behavior and outcomes as they largely influence personal aspiration and self-efficacy (Bandura, 2001). Considering they are likely well informed about how exercise alleviates their MS symptoms and have the resources and environmental support to engage in exercise, it is likely that they have high intention to push themselves to engage in exercise even though they may have suffered pain and fatigue, both of which have affected physical health significantly and decrease physical health.

Outcome expectancy is a key concept of Bandura's SCT, providing further support for this theory and its application for health promotion in individuals with MS. Bandura explains that outcome expectations are critical in influencing initial motivation, as well as the decision to initiate new health behavior (Bandura, 2004). If one perceives more positive outcome expectations than negative expectations associated with a behavior then they are more apt to

engage in the behavior (Bandura, 2004). Conversely, perceiving more negative outcome expectations than positive outcome expectations would result in avoidance of the behavior (Bandura, 2004). Therefore, it would be important for rehabilitation counselors to increase an individual's awareness of the benefits of adopting a new behavior (such as physical activity), and focus on positive outcome expectations to encourage exercise which would in turn improve their physical health.

This finding builds upon past literature as it further examines which particular variables may best be used to explain physical health for persons with MS and the role outcome expectancy plays for people with MS engaging in physical activity (Ferrier, Dunlop, & Blanchard, 2010; Dlugonski, Wojcicki, McAuley, & Motl, 2011). Results compliment those found in past studies as physical health was found to be positively associated with outcome expectancy suggesting increased physical health as more positive outcome expectancies were associated with physical activity (Ferrier, Dunlop, & Blanchard, 2010; Dlugonski, Wojcicki, McAuley, & Motl, 2011).

Furthermore, this finding expands upon past studies as the variable of severity of disability was examined and found to be a critical variable to affect physical health, and ultimately health promoting behaviors. Considering age, severity of disability, and outcome expectancy are the greatest predictors of physical health, it would be important for rehabilitation programs to consider these findings when working with MS patients to design an exercise plan. While only time can modify age, this study suggests outcome expectancy should be an area of focus with MS patients when considering how to encourage an increase in physical activity. As past literature suggests, engaging in exercise positively affects physical health and decreases severity of disability in persons with MS (Döring, Pfueller, Paul, & Dörr, 2012; Stroud,

Minahan, 2009; Sullivan, Scheman,Venesy, & Davin, 2012). This information is a good resource of evidence-based practice and would be a key part of health education to people with MS when a rehabilitation counselor works on health intervention and promotion efforts with this population.

When examining the fourth aim, mental health, the final model accounted for 20% of the variance in mental health. Age, barriers, outcome expectancy, and action self-efficacy were all significant individual predictors of mental health. Outcome expectancy and barriers and were found to be most statistically significant but negatively associated with mental health. According to results of the CES-D, most participants met the cutoff score for classification of mild depressive symptomology. As literature suggests, depression often impairs rational thinking and decreases motivation to engage in various daily activities (Siegert & Abernethy, 2005). It is likely that the current study's sample has high expectations from their exercise, as they have likely been informed of the improvements it will make in their health. Consequently, creating such high expectations may result in stress and anxiety which would negatively affect mental health. Additionally, if the positive effects of exercise are not as great as they expected, or they do not experience the effects as soon as they hoped, it may lead to disappointment and depression. Furthermore, the majority of participants reported they were not receiving individual counseling, which literature supports as a form of action-oriented management of depression and is associated with decreased distortion and negative perception of events (Siegert & Abernethy, 2005). It is possible that this population is not receiving appropriate professional help to address any depressive symptomology which could assist them in creating, or adjusting, their outcome expectations so that they are realistic and appropriate, as well as provide strategies to employ if their positive expectations of exercise are not met in the timeframe they expect.

Bandura emphasizes the role barriers play in relation to behavioral change explaining when one perceives few barriers to a behavior, they are likely to be successful in carrying out an action, which positively affects perceived self-efficacy (Bandura, 2004). Considering barriers were negatively associated with mental health it would be important for rehabilitation counselors to assist MS patients identify what interferes with them engaging in physical activity. Rehabilitation counselors could use specific therapeutic techniques (such as Motivational Interviewing or Cognitive Behavioral Therapy) and individualize sessions with MS patients to discuss strategies for overcoming barriers. Additionally, rehabilitation counselors could provide psychoeducation for patients to help them learn about their perception of obstacles and external stressors and approaches to managing, overcoming, and coping with challenges. Providing such treatment would allow individuals to learn how to healthily and productively identify obstacles and increase their confidence in their ability to overcome challenges. Utilization of these resources and tools would empower MS patients, and increase the likelihood that they would engage in physical activity, which would positively influence their mental health and improve their overall quality of life.

Limitations and Future Research

There are several limitations in this study that should be considered when interpreting the results and addressed in future research. First, a convenience sample was used which may not accurately reflect the national MS population demographics. For example, socioeconomic status may be higher than a representative sample because this study required using the internet, to which access is limited for low SES people. Also, the participants are all members of the National Multiple Sclerosis Society who visit the association's website which means they are likely to be younger, more comfortable with technology and highly educated (as results showed).

Furthermore, participants in this study may have more knowledge of health benefits and greater access to healthcare and supportive community resources than among a representative sample.

Additionally, most (53%) participants reported a yearly household income over $50,000 (35.3%), with a median of over $75,000. Comparing annual household income from the sample to the 2011 national statistics (*M* = $42,979.61, median: $50,502) confirms a bias in this area (Noss, 2011). Future studies should examine the effect of socioeconomic status on exercise in persons with MS by including a greater number of individuals with MS from lower socioeconomic backgrounds and who, on average, identify as having less resources and community support than this sample. The vast majority of participants identified as White (79%), indicating that people from racial and ethnic minority backgrounds were not well represented in this study. Therefore, future studies should utilize more diverse participant samples. In fact, doing so may continue to identify and clarify demographic factors that affect physical activity self-management in people with MS.

Furthermore, this study examined disability in terms of ADLs and IADLs. Regarding mobility and basic ADLs, participants in this study were mildly disabled. However, their IADLs, or social and environmental functioning, suggested greater disability in these domains. Considering the variability of two kinds of disability severity, it is important for future studies to explore the effect and relationship between each classification of disability as they relate to, or influence, various aspects of lives of persons with MS.

Finally, this study relied solely on subjective self-report measures for data collection thereby limiting the accuracy of comparisons to those studies with objective measures (such as pedometers). Therefore future studies should continue to incorporate both subjective and objective indicators to allow for optimal accuracy when contrasting with previous studies.

Implications for Rehabilitation Counseling Practice

The present study has identified several factors that are important to apply to health promotion for persons with MS, which has several implications for rehabilitation counseling practice. First, there is a tremendous need for effective health promotion programs for people with disabilities. Unfortunately, existing health promotion efforts often fail to target the needs of people with disabilities and they are often neglected in the development of preventative health activity programs (World Health Organization, 2013). In reviewing the website for new national health agenda, Healthy People 2020 (USDHHS, 2013), the related topics of "Physical Activity" and "Disability and Health" are particularly relevant to this discussion. There is little mention of people with disabilities in the overview and objectives pages of the "Physical Activity" topic, and there is little attention given to physical activity and exercise in the overview and objectives pages of the "Disability and Health" section.

Additionally, this study examines two domains of disability. Initial analyses utilized the *Incapacity Status Scale* (ISS) for disability from the MRD to define disability. Under this classification, the current sample was mildly disabled. Given the health status of the current sample, functional disability in activities of daily living were largely unaffected. However, further analyses utilized the *Environmental Status Scale* (ESS) from the MRD to define disability. Given this definition, the current sample's instrumental activities of daily living (IADL) and social and environmental functioning were considerably more impacted by MS than their ADLs. While the current sample is not severely disabled, physical activity would be critical for symptom management and to minimize existing disability this sample is experiencing. Essentially, physical activity may potentially increase independent functioning for their instrumental activities of daily living and likely improve their quality of life. Considering

the significant difference between MRD-subtest 2 and MRD-subtest 1, ($t_{(213)} = 3.73$, $p = .000$) within this sample, it is suggested that health intervention programs identify their population's classification of disability to effectively tailor programs to address specific needs of patients based on their disability. Additionally, future research should further examine other domains of disability as they relate to mental and physical health, and determine if additional variables may play a role in influencing disability.

Our study's results indicated there was not a significant interaction between severity of disability and action self-efficacy when examining all four aims (action planning and coping planning, stage of change, physical health, and mental health). The current's study's sample is unique, as previously discussed, as they are fairly affluent, well-educated, and mildly disabled in terms of functional disability. However, while severity of disability may not be directly mediated by action self-efficacy in this study, there is a substantial amount of literature supporting the notion that self-efficacy plays in key role in influencing, predicting, and explaining disability.

Literature notes that individuals with MS report a lower sense of self-efficacy than do those without the disease, and interestingly, self-efficacy can be an important predictor of disability (Shnek et al., 1997; Barlow, 2013). A greater sense of self-efficacy is associated with a decrease in disability, providing support for the notion that self-efficacy positively influences various health status outcomes, such as psychological well-being or physical functioning (Barlow, 2013). Self-efficacy has been positively associated with better health status outcomes in a range of conditions relevant to rehabilitation and is often thought to act either as a moderator or mediator in a rehabilitative framework (Barlow, 2013). Self-efficacy is considered a critical

component of SCT to evaluate and incorporate throughout the rehabilitative process (Motl et al. 2009; Barlow, 2013).

While a concern for the health of all adults (including people with chronic health issues and disabilities) is expressed, the general health promotion efforts neither address specific disabilities (i.e., MS) nor people with disabilities in general. Evidence from the prior literature and present study suggests meeting the health needs of people with disabilities requires rehabilitation and health professionals to be mindful of this population in the design and implementation of disease prevention and health promotion initiatives. Although health promotion theories and models are used to aid in the design of such programs should use models that have been validated for people with disabilities and more specifically for people with MS in order to customize service for this population.

Furthermore, health promotion efforts to improve the mental health of people with disabilities are equally as relevant. While our study's sample was considered to be relatively physically healthy, aside from MS; a significant difference between SF-12 Physical Health and Mental Health ($t_{(213)} = -12.94$, $p = .000$) indicated that participants identified a greater decline in mental health than physical health. Literature suggests individuals with MS are at a 50% lifetime risk for depression (Arnett, Barwick, & Beeney, 2008). This finding and past literature allude to the importance of addressing mental health concerns in individuals with chronic disabilities as mental health is a key facet of quality of life. Our findings suggest that perceived barriers (an important SCT concept) largely influences mental health in persons with MS.

Rehabilitation counselors could treat people with disabilities by assessing and detecting physical, psychological, and vocational difficulties, by providing a comprehensive and modifiable treatment intervention specifically tailored to meet patient's individual needs.

Additionally, health intervention focused on decreasing emotional stress and learning effective coping and management skills could aid persons with disabilities and improve their overall quality of life. Mental health cannot be neglected in the care of persons with disabilities, and addressing this component of health ensures that a biopsychosocial, and well-validated, approach is taken to provide the most efficacious rehabilitative treatment.

The present study's findings support the applicability of Bandura's social cognitive concepts for health promotion and exercise participation for people with MS. The four significant variables as associated with health promotion and subsequent follow-up analyses using action planning and coping planning, stage of change, physical health, and mental health as the outcome variables indicated that "action planning and coping planning" was predicted by action self-efficacy, a key component of Bandura's SCT. Results compare favorably to a similar study that examined the relationship between SCT concepts and physical activity in persons with MS and found a positive relationship between self-efficacy and physical activity ($\beta = .22$, $p < .01$; Morris, McAuley, & Motl, 2008).

Counseling interventions focusing on enhancing self-efficacy related to physical activity will increase the patient's sense of action planning and coping planning, ultimately increasing physical activity and exercise participation, as well as improve the likelihood of maintaining the behavioral change by persevering through various challenges that arise. These interventions should consider including this component and focusing on increasing action self-efficacy in a tailored fashion for people with MS.

Furthermore, because "stage of change" is predicted by action planning and coping planning, improvement in the area of action planning and coping planning will likely positively affect stage of change. The present study suggests action planning and coping planning serve as

a proxy of goal-setting, and Bandura's SCT framework emphasizes the importance of creating realistic goals prior to enacting behavioral change (Bandura, 2004). For clinical utility, if a patient works to identify a realistic and appropriate goal, they are more likely to experience success with behavioral change which would then positively affect their self-efficacy (Bandura, 2004). This is consistent with the fact that there is considerable overlap between SCT concepts, as the present findings, and prior literature suggest.

Results compliment those found in a study by Dlugonski and colleagues that identified goal-setting as a significant correlate of physical activity (R^2 = 10%, β = .31, p = .023; Dlugonski, Wojcicki, McAuley, & Motl, 2011). Given the aforementioned findings, counseling interventions tailored to work with patients to increase their confidence by creating a plan of action and discussing potential ways to cope with unexpected events may serve to facilitate a change in behavior. For example, a rehabilitation professional could work with the patient to create appropriate sub-goals to work towards the ultimate goal of fully implementing an appropriate exercise routine.

Additionally, results indicated that when "physical health" was the outcome variable, it was predicted by age, severity of disability, action self-efficacy, outcome expectancy. These results compare favorably with a study by Dlugonski and colleagues, 2011 that found a positive relationship between physical activity and outcome expectations (r = .29, p < .02). While results corroborate past studies, they are also novel findings that highlight the importance of evaluating a patient's age and perceived level of disability as it relates to their physical health, and more importantly suggests the importance of outcome expectancy as it influences their physical health. Counseling interventions may also benefit from taking age into account and focusing on

enhancing patients' perceived benefits and outcome expectations by adopting a behavior (i. e., exercise) thereby increasing their physical health.

In terms of clinical application, improving the positive association and perceived positive outcome expectancy exercise may have on physical health for patients with MS could be done by educating MS patients on the numerous advantages physical activity would have on their physical health. Additionally, professionals could help patients identify how their functioning and IADLs could be improved by incorporating physical activity into their everyday routine. Furthermore, as prior literature suggests, exercise is an efficacious method of managing various MS symptoms (Motl, Arnett, Smith, Barwick, Ahlstrom, & Stover, 2008). Considering exercise is a well-validated approach to management of MS symptoms, a rehabilitation professional could work with patients to increase their awareness of the positive effects of exercise, and discuss their expectations of such a change in exercise engagement, helping them to identify perceived benefits as well as realistic and positive outcome expectations.

Lastly, when "mental health" was the outcome variable, it was predicted by age, outcome expectancy, action self-efficacy, and perceived barriers. This suggests that rehabilitation professionals could focus efforts by working with individuals with MS to help them minimize perceived barriers. This will likely facilitate a more positive sense of mental health, increase their sense of action self-efficacy, and in turn increase the likelihood of engaging in physical activity. Further, consistent with Bandura's theory and the present findings, working with patients to address concerns or foreseeable obstacles should also positively affect their mental health, and ultimately their ability to adopt a behavioral change such as exercise (Bandura, 2004). Additionally, it would be helpful for rehabilitation counselors to work with MS patients and discuss the ways in which physical activity would positively affect their mental health, and

their overall lives so as to increase the positive outcome expectations associated with physical activity. The SF-12 addresses ways in which regular daily activities and mood are affected by mental health, more specifically “emotional problems”. Such activities include ability to complete work and attention paid to tasks. Regarding mood, the SF-12 poses questions about level of energy, and feelings of depression.

In a clinical application, rehabilitation counselors could work with MS patients and discuss how depression interferes with such instrumental activities of daily living (IADLs). Discussing how physical activity could positively affect their mental health may serve as a critical positive outcome expectancy associated with physical activity. If an MS patient recognizes how their emotional and mental health impacts so many facets of their life, and that physical activity could improve their mental health, they would likely be inclined to adopt such a new behavior. Additionally, a rehabilitation counselor could work with MS patients to adopt realistic expectations, as well as manage the anxiety or stress they may experience if expectations are not met in a timeframe they predicted. Working with patients to manage any anxiety and stress that may arise from such expectations would be critical to ensure improvement in mental health.

Finally, it is important to consider the role of work and employment-seeking with regard to health promoting behaviors. Good health and physical stamina are important to obtaining and retaining employment. The significant predictor SCT variables in this study can be used to design and validate future health promotion behavioral intervention programs for people with MS in vocational rehabilitation. Exercise and physical activity inhibit secondary conditions and functional limitations, which then promote job acquisition and retention. Thus, a focus on health promotion complements rehabilitation employment services aimed at promoting independence

and functioning.

Rehabilitation counselors have the opportunity to play a pivotal role in promoting health behaviors at the consumer level. Specifically, rehabilitation counselors can assist consumers with decision-making, problem solving barriers, promoting behaviors to increase self-efficacy and action planning and coping planning, and negotiating a balance between time demands of work-related (or job-seeking) activities and physical exercise. Moreover, rehabilitation counselors may be useful in addressing demand-side needs, such as assisting employers with developing customizable health programs and initiatives for employees that ensures full inclusion and accessibility for workers with disabilities.

In summary, this study supports the application of a biopsychosocial approach to the use of physical activity for MS symptom management. Examining the social/cognitive, physical health, and mental health domains provides a well-rounded and empirical basis for using health promotion efforts in clinical work with people with MS. Exercise may not only serve as a means for symptoms management, but also as a critical component to increasing overall quality of life (Centers for Disease Control and Prevention, 2013; National Multiple Sclerosis Society, 2013). Therefore, rehabilitation professionals should consider helping persons with MS implement self-management and regulation of mobility impairment, pain, fatigue, and depression through physical activity through the use of various social cognitive concepts. These findings of the relationships between SCT concepts and action planning coping planning, stage of change, mental health and physical health can enable treatment teams, clinicians, and health professionals to better create and customize treatment to best meet individual patients' needs.

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Table 1

Demographic Information for all Participants (N =214)

Demographics	*n* (%)	Mean (*M*)	Range	Standard Deviation (*SD*)
Gender				
Female	185 (11.9%)			
Male	25 (88.1%)			
Ethnicity/Race				
European American	169 (79%)			
Native American	14 (6.5%)			
Latino American	3 (1.4%)			
African American	23 (10.7%)			
Asian America	5 (2.3%)			
Relationship Status				
Never Married	28 (13.1%)			
Married	150 (70.1%)			
Widowed	4 (1.9%)			
Divorced	19 (8.9%)			
Separated	5 (2.3%)			
Cohabitating	8 (3.7%)			
Health Insurance				
Private insurance through employment	119 (55.6%)			
Private insurance through other means	52 (24.3%)			
Medicare	49 (22.9%)			
Medicaid	12 (5.6%)			
None	8 (3.7%)			
Other	19 (8.9%)			
Other Current Health Problems				
Overweight	16 (7.5%)			
Underweight	2 (0.9%)			
High blood pressure	43 (20.1%)			
High cholesterol	33 (15.4%)			
Diabetes	12 (5.6%)			
None	115 (53.7%)			
Other	47 (22%)			
Education				
Some High School	2 (0.9%)			
High School Graduate	20 (9.3%)			
Some College	73 (34.1%)			
College Graduate	73 (34.1%)			
Graduate School	46 (21.5%)			
Vocation Status				
Unemployed	27 (12.6%)			

Retired Due to MS	77 (36%)
Employed Full-Time	76 (35.5%)
Employed Part-Time	28 (13.1%)
Student	3 (1.4%)
Volunteer Full-Time	0
Volunteer Part-Time	15 (7%)
Occupation	
Laborer	5 (2.3%)
Student	6 (2.8%)
Service Worker	10 (4.7%)
Operator	4 (1.9%)
Craftsman	3 (1.4%)
Clerical or Sales	36 (16.8%)
Manager	18 (8.4%)
Professional	65 (30.4%)
Living Area	
Large Urban (Population > 100,000)	70 (32.7%)
Medium Urban (Population 20,000-90,000)	66 (30.8%)
Suburban/Small Town (Population < 20,000)	58 (27.1%)
Rural	20 (9.3%)
Number of People Living with Participant	
Zero	28 (13.3%)
One	94 (44.8%)
Two	33 (15.7%)
Three	33 (15.7%)
Four	16 (7.6%)
Five	5 (2.4%)
Six	1 (0.5%)
Current Health Care and Rehabilitation Services	
Medical Treatment	203 (94.9%)
Physical Therapy	34 (15.9%)
Occupational Therapy	12 (5.6%)
Exercise Therapy	27 (12.6%)
Individual Counseling	31 (14.5%)
Group Counseling	10 (4.7%)
Psychological Assessment	13 (6.1%)
Vocational Assessment	3 (1.4%)
Vocation/Employment Training or Placement	0
Other	8 (3.7%)
Source of Income	
Own Employment	104 (48.6%)
Employment of Family Member	89 (41.6%)
SSI	16 (7.5%)
SSDI	54 (25.2%)
Private Disability	26 (12.1%)
Household Income	

Under $24,999	31 (15%)			
$25,000-34,999	30 (14.5%)			
$35,000-49,999	33 (15.9%)			
$50,000-74,999	40 (19.3%)			
Over $75,000	73 (35.3%)			
Community Exercise Resources				
Exercise Equipment at Home	136 (63.6%)			
Community Recreational Clubs	65 (30.4%)			
Community Centers with Exercise Equipment	65 (30.4%)			
Neighborhood Walking/Biking Paths	106 (49.5%)			
Private Health Club	79 (36.9%)			
Other	9 (4.2%)			
Lifestyle Changes Since MS Onset				
Change in Exercise	159 (75.4%)			
Change in Diet	85 (40.1%)			
Change in Sleep Pattern	125 (59.5%)			
Change in Relaxation	118 (55.7%)			
Age	214	46.97	19-64	9.92
Years Since MS Onset	214	10.6	.06-39	8.88

Table 2

Results for all Measures (N = 214)

Measure	*n*	Mean *(M)*	Range	Standard Deviation *(SD)*
CES-D 10	214	11.77	1-24	4.74
Minimal Record of Disability (MRD)	214			
Incapacity Status Scale		.92	.00-3.06	.648
Environmental Status Scale		1.09	.00-5	1.06
ASES-PE	214	2.66	1-4	.818
OES-PE	214	3.34	1-4	.647
HRPS	214	4.21	2-5	.704
APCPS-PE	214			
Action Planning Scale		2.91	1-4	.966
Coping Planning Scale		2.36	1-4	1.02
BHADP	214	1.80	1.11-3.11	.437
MOS (SF-12v12)	214			
Physical Component Summary Scale		34.91	12.98-60.23	8.30
Mental Component Summary Scale		47.99	20.95-67.23	8.25
Eight Subscales of the MOS				
Physical Functioning		36.34	22.11-56.47	13.04
Role limitations due to physical problems		36.25	20.32-57-18	12.06
Bodily Pain		31.61	16.68-57.44	12.86
General Health		41.23	18.87-55.52	12.65
Vitality Scale		53.72	27.62-67.88	10.35
Social Functioning		42.34	16.18-56.57	11.93
Role limitations due to emotional problems		40.05	11.35-56.08	14.39
Mental Health		43.26	15.77-58.45	5.44

Measure	*n*	%	Cumulative Percent
Frequency of Stage of Change on the PASC			
1.00 (Precontemplation)*	52	24.3	24.3
2.00 (Contemplation)*	11	5.1	29.4
3.00 (Preparation)*	51	23.8	53.3
4.00 (Action)	22	10.3	63.6
5.00 (Maintenance)	78	36.4	100

Note. * Most (53.3%) of participants were currently in the first three stages of change (Precontemplation, Contemplation, or Preparation)

Measure	*N*	%	Cumulative Percent
Frequency of Severity of Score on the CES-D 10 Severity Score			
1.00	1	.5	.5
2.00	2	.9	1.4
3.00	3	1.4	2.8
3.50	1	.5	3.3
4.00	5	2.3	5.6
5.00	3	1.4	7
6.00	10	4.7	11.7
6.50	1	.5	12.1
7.00	12	5.6	17.8
7.50	1	.5	18.2
8.00	13	6.1	24.3
9.00	25	11.7	36
10.00	21	9.8	45.8
10.50	1	.5	46.3
11.00*	14	6.5	52.8
11.50	1	.5	53.3
12.00	13	6.1	59.3
13.00	14	6.5	65.9
13.50	1	.5	66.4
14.00	10	4.7	71
14.50	1	.5	71.5
15.00	10	4.7	76.2
16.00	10	4.7	80.8
17.00	9	4.7	85
18.00	12	5.6	90.7
19.00	8	3.7	94.4
20.00	5	2.3	96.7
21.00	1	.5	97.2
22.00	3	1.4	98.6
23.00	2	.9	99.5
24.00	1	.5	100

Note. *When interpreting the CES-D 10, a score equal to or greater than 11 is advised to interpret as “significant or “mild” depressive symptomology.

Table 3

Correlations for Variables Used in Hierarchical Regression Analysis for Action Planning and Coping Planning-Exercise

Variable	1	2	3	4	5	6	7	8	9	10
1. Action Planning and Coping Planning-Exercise	--									
2. Age	.09	--								
3. Education	.11	.07	--							
4. Household Income	.18**	-.04	.28***	--						
5. Severity of Disability	-.10	.28***	-.21**	-.29***	--					
6. Barriers	-.37***	.06	-.21**	-.35***	.52***	--				
7. Action Self-Efficacy	.59***	-.04	.16*	.21**	-.23**	-.46***	--			
8. Outcome Expectancy	.42***	-.07	.12*	.20**	-.26***	-.33***	.34***	--		
9. Risk Perception	.37***	.01	-.10	.11	-.00	-.13*	.27***	.43***	--	
10. Interaction between severity of disability and action self-efficacy	.16*	.27***	-.17**	-.20**	.86***	.31***	.22**	-.09	.14*	--

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

Table 4

Hierarchical Regression Analysis for Prediction of Action Planning and Coping Planning-Exercise

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1*				
Household income	.04	.04*	.17*	.01
Age			.09	.10
Education			.06	.01
Step 2*				
Severity of Disability	.05	.01	-.09	.09
Step 3***				
Barriers	.16	.11***	-.41***	-.14
Step 4***				
Risk Perception	.45	.29***	.14*	.14*
Outcome Expectancy			.19**	.19**
Action Self-Efficacy			.45***	.45***
Step 5***				
Interaction between Disability and Action Self- Efficacy	.45	.00	-.02	-.02

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

Table 5

Correlations for Variables Used in Hierarchical Regression Analysis for of Action Planning and Coping Planning-Exercise-Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9
1. Action Planning and Coping Planning-Exercise	--								
2. Age	.09	--							
3. Education	.11	.07	--						
4. Household Income	.18**	-.04	.28***	--					
5. Severity of Disability	-.10	.28***	-.21**	-.29***	--				
6. Barriers	-.37***	.06	-.21**	-.35***	.52***	--			
7. Action Self-Efficacy	.59***	-.04	.16*	.21**	-.23**	-.46***	--		
8. Outcome Expectancy	.42***	-.07	.12*	.20**	-.26***	-.33***	.34***	--	
9. Risk Perception	.37***	.01	-.10	.11	-.00	-.13*	.27***	.43***	--

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

Table 6

Hierarchical Regression Analysis for Prediction of Action Planning and Coping Planning-Exercise-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1*				
Household income	.04	.04*	.17*	.01
Age			.09	.10
Education			.06	.01
Step 2*				
Severity of Disability	.05	.01	-.09	.10
Step 3***				
Barriers	.16	.11***	-.41***	-.14
Step 4***				
Risk Perception	.45	.29***	.14*	.14*
Outcome Expectancy			.19**	.19**
Action Self-Efficacy			.45***	.45***

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

Table 7

Correlations for Variables Used in Hierarchical Regression Analysis for Stage of Change-Exercise

Variable	1	2	3	4	5	6	7	8	9	10
1. Stage of Change-Exercise	--									
2. Age	-.02	--								
3. Education	.19**	.07	--							
4. Household Income	.27***	-.04	.28***	--						
5. Severity of Disability	-.24***	.28***	-.21**	-.29***	--					
6. Barriers	-.29***	.06	-.21**	-.35***	.52***	--				
7. Action Self-Efficacy	.35***	-.04	.16*	.21**	-.23**	-.46***	--			
8. Outcome Expectancy	.37***	-.07	.12*	.20**	-.26***	-.33***	.34***	--		
9. Risk Perception	.29***	.01	-.10	.11	-.00	-.13*	.27***	.43***	--	
10. Action Planning and Coping Planning-Exercise	.43***	.09	.11	.18**	-.10	-.37***	.59***	.42***	.37***	--
11. Interaction between severity of disability and action self-efficacy	.03	.03	-.11	.01	-.11	-.05	.06	.06	.11	.04

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

Table 8

Hierarchical Regression Analysis for Prediction of Stage of Change-Exercise

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1***				
Age	.09	.09***	-.02	-.01
Education			.13	.09
Household income			.23**	.11
Step 2***				
Severity of Disability	.11	.02*	-.17*	-.12
Step 3***				
Barriers	.13	.02*	-.17*	.01
Step 4***				
Action Self-Efficacy	.25	.12***	.17*	.05
Outcome Expectancy			.19*	.13
Risk Perception			.16*	.12
Step 5***				
Action Planning and Coping Planning-Exercise	.29	.04**	.27**	.27**
Step 6***				
Interaction between Disability and Action Self- Efficacy	.29	.00	-.01	-.01

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

Table 9

Correlations for Variables Used in Hierarchical Regression Analysis for Stage of Change-Exercise-Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9	10
1. Stage of Change-Exercise	--									
2. Age	-.02	--								
3. Education	.19**	.07	--							
4. Household Income	.27***	-.04	.28***	--						
5. Severity of Disability	-.24***	.28***	-.21**	-.29***	--					
6. Barriers	-.29***	.06	-.21**	-.35***	.52***	--				
7. Action Self-Efficacy	.35***	-.04	.16*	.21**	-.23**	-.46***	--			
8. Outcome Expectancy	.37***	-.07	.12*	.20**	-.26***	-.33***	.34***	--		
9. Risk Perception	.29***	.01	-.10	.11	-.00	-.13*	.27***	.43***	--	
10. Action Planning and Coping Planning-Exercise	.43***	.09	.11	.18**	-.10	-.37***	.59***	.42***	.37***	--

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

Table 10

Hierarchical Regression Analysis for Prediction of Stage of Change-Exercise-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1***				
Age	.09	.09***	-.02	-.01
Education			.13	.09
Household income			.23**	.11
Step 2***				
Severity of Disability	.11	.02*	-.17*	-.12
Step 3***				
Barriers	.13	.02*	-.17*	.01
Step 4***				
Action Self-Efficacy	.25	.12***	.17*	.05
Outcome Expectancy			.19*	.13
Risk Perception			.16*	.12
Step 5***				
Action Planning and Coping Planning-Exercise	.29	.04**	.27**	.27**

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

Table 11

Correlations for Variables Used in Hierarchical Regression for Physical Health

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Physical Health	--											
2. Age	-.28***	--										
3. Education	.05	.07	--									
4. Household Income	.06	-.04	.28***	--								
5. Severity of Disability	-.29***	.28***	-.21**	-.29***	--							
6. Barriers	-.06	.06	-.21**	-.35***	.52***	--						
7. Action Self-Efficacy	-.05	-.04	.16*	.21**	-.23**	-.46***	--					
8. Outcome Expectancy	.28***	-.07	.12*	.20**	-.26***	-.33***	.34***	--				
9. Risk Perception	.05	.01	-.10	.11	-.00	-.13*	.27***	.43***	--			
10. Action Planning and Coping Planning-Exercise	.00	.09	.11	.18**	-.10	-.37***	.59***	.42***	.37***	--		
11. Stage of Change-Exercise	.08	-.02	.19**	.27***	-.24***	-.29***	.35***	.37***	.29***	.43***	--	
12. Interaction between severity of disability and action self-efficacy	-.10	.03	-.11	.01	-.11	-.05	.06	.06	.11	.04	.03	--

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

Table 12

Hierarchical Regression Analysis for Physical Health

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Age	.08	.08**	-.28***	-.19**
Education			.06	.02
Household income			.03	-.02
Step 2***				
Severity of Disability	.13	.04**	-.23**	-.27**
Step 3***				
Barriers	.13	.01	.11	.11
Step 4***				
Risk Perception	.21	.08***	-.01	.00
Outcome Expectancy			.29***	.29***
Action Self-Efficacy			-.16*	-.16
Step 5***				
Action Planning and Coping Planning Exercise	.21	.00	.02	.01
Step 6***				
Stage of Change Exercise	.21	.00	-.00	-.01
Step 7***				
Interaction Between Severity of Disability and Action Self-Efficacy	.22	.01	-.12	-.12

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

Table 13

Correlations for Variables Used in Hierarchical Regression for Physical Health-Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9
1. Physical Health	--								
2. Age	-.28***	--							
3. Education	.05	.07	--						
4. Household Income	.06	-.04	.28***	--					
5. Severity of Disability	-.29***	.28***	-.21**	-.29***	--				
6. Barriers	-.06	.06	-.21**	-.35***	.52***	--			
7. Action Self-Efficacy	-.05	-.04	.16*	.21**	-.23**	-.46***	--		
8. Outcome Expectancy	.28***	-.07	.12*	.20**	-.26***	-.33***	.34***	--	
9. Risk Perception	.05	.01	-.10	.11	-.00	-.13*	.27***	.43***	--

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

Table 14

Hierarchical Regression Analysis for Physical Health-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Age	.08	.08**	-.28***	-.20**
Education			.06	.03
Household income			.03	-.02
Step 2***				
Severity of Disability	.13	.04**	-.23**	-.25**
Step 3***				
Barriers	.13	.01	.11	.11
Step 4***				
Risk Perception	.21	.08***	-.01	-.01
Outcome Expectancy			.29***	.29***
Action Self-Efficacy			-.16*	-.16*

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

Table 15

Correlations for Variables Used in Hierarchical Regression Analysis for Mental Health

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Mental Health	--											
2. Age	.12*	--										
3. Education	.09	.07	--									
4. Household Income	.20**	-.04	.28***	--								
5. Severity of Disability	-.20**	.28***	-.21**	-.29***	--							
6. Barriers	-.27***	.06	-.21**	-.35***	.52***	--						
7. Action Self-Efficacy	.19**	-.04	.16*	.21**	-.23**	-.46***	--					
8. Outcome Expectancy	-.12*	-.07	.12*	.20**	-.26***	-.33***	.34***	--				
9. Risk Perception	-.06	.01	-.10	.11	-.00	-.13*	.27***	.43***	--			
10. Action Planning and Coping Planning-Exercise	-.00	.09	.11	.18**	-.10	-.37***	.59***	.42***	.37***	--		
11. Stage of Change-Exercise	.06	-.02	.19**	.27***	-.24***	-.29***	.35***	.37***	.29***	.43***	--	
12. Interaction between severity of disability and action self-efficacy	.22**	.03	-.11	.01	-.11	-.05	.06	.06	.11	.04	.03	--

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

Table 16

Hierarchical Regression Analysis for Mental Health

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Household income	.06	.06**	.19**	.13
Age			.13	.17*
Education			.03	.00
Step 2**				
Severity of Disability	.09	.04**	-.21**	-.10
Step 3***				
Barriers	.11	.02*	-.19*	-.22*
Step 4***				
Risk Perception	.19	.07**	-.02	-.02
Outcome Expectancy			-.27***	-.25**
Action Self-Efficacy			.15	.21*
Step 5***				
Action Planning and Coping Planning Exercise	.20	.02	-.16	-.17
Step 6***				
Stage of Change Exercise	.20	.00	.03	.03
Step 7***				
Interaction Between Severity of Disability and Action Self-Efficacy	.24	.04**	.20**	.20**

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

Table 17

Correlations for Variables Used in Hierarchical Regression Analysis for Mental Health- Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9	10
1. Mental Health	--									
2. Age	.12*	--								
3. Education	.09	.07	--							
4. Household Income	.20**	-.04	.30***	--						
5. Severity of Disability	-.20**	.28***	-.21**	-.29***	--					
6. Barriers	-.27***	.06	-.21**	-.35***	.52***	--				
7. Action Self-Efficacy	.19**	-.04	.16*	.21**	-.23**	-.46***	--			
8. Outcome Expectancy	-.12*	-.07	.12*	.20**	-.26***	-.33***	.34***	--		
9. Risk Perception	-.06	.01	-.10	.11	-.00	-.13*	.27***	.43***	--	
10. Interaction between severity of disability and action self-efficacy	.22**	.03	-.11	.01	-.11	-.05	.06	.06	.11	--

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

Table 18

Hierarchical Regression Analysis for Mental Health-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Household income	.06	.06**	.19**	.13
Age			.13	.15*
Education			.03	.01
Step 2**				
Severity of Disability	.09	.04**	-.21**	-.12
Step 3***				
Barriers	.11	.02*	-.19*	-.20*
Step 4***				
Risk Perception	.19	.07**	-.02	-.04
Outcome Expectancy			-.27***	-.27***
Action Self-Efficacy			.15	.14
Step 5***				
Interaction Between Severity of Disability and Action Self-Efficacy	.22	.04**	.20**	.20**

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

Table 19

Correlations for Variables Used in Hierarchical Regression Analysis for Action Planning and Coping Planning-Exercise

Variable	1	2	3	4	5	6	7	8	9	10
1. Action Planning and Coping Planning-Exercise	--									
2. Age	.09	--								
3. Education	.11	.07	--							
4. Household Income	.18**	-.04	.28***	--						
5. Severity of Social/Environmental Disability	-.12*	.26***	-.22**	-.39***	--					
6. Barriers	-.37***	.06	-.21**	-.35***	.51***	--				
7. Action Self-Efficacy	.59***	-.04	.16*	.21**	-.24***	-.46***	--			
8. Outcome Expectancy	.42***	-.07	.12*	.20**	-.32***	-.33***	.34***	--		
9. Risk Perception	.37***	.01	-.10	.11	-.02	-.13*	.27***	.43***	--	
10. Interaction between severity of disability and action self-efficacy	.09	.25***	-.19**	-.32***	.89***	.37***	.11	-.20**	.10	--

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

Table 20

Hierarchical Regression Analysis for Action Planning and Coping Planning-Exercise

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1*				
Household income	.04	.04*	.17*	.03
Age			.09	.10
Education			.06	.01
Step 2*				
Severity of Disability	.05	.01	-.08	.17
Step 3***				
Barriers	.16	.11***	-.40***	-.14
Step 4***				
Risk Perception	.45	.29***	.14*	.14*
Outcome Expectancy			.20**	.20**
Action Self-Efficacy			.45***	.47***
Step 5***				
Interaction between Disability and Action Self- Efficacy	.45	.00	-.06	-.06

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

Table 21

Correlations for Variables Used in Hierarchical Regression Analysis for Action Planning and Coping Planning-Exercise-Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9
1. Action Planning and Coping Planning-Exercise	--								
2. Age	.09	--							
3. Education	.11	.07	--						
4. Household Income	.18**	-.04	.28***	--					
5. Severity of Social/Environmental Disability	-.12*	.26***	-.22**	-.39***	--				
6. Barriers	-.37***	.06	-.21**	-.35***	.51***	--			
7. Action Self-Efficacy	.59***	-.04	.16*	.21**	-.24***	-.46***	--		
8. Outcome Expectancy	.42***	-.07	.12*	.20**	-.32***	-.33***	.34***	--	
9. Risk Perception	.37***	.01	-.10	.11	-.02	-.13*	.27***	.43***	--

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

Table 22

Hierarchical Regression Analysis for Prediction of Action Planning and Coping Planning-Exercise-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1*				
Household income	.04	.04*	.17*	.03
Age			.09	.10
Education			.06	.01
Step 2*				
Severity of Disability	.05	.01	-.08	.12
Step 3***				
Barriers	.16	.11***	-.40***	-.14*
Step 4***				
Risk Perception	.45	.29***	.14*	.14*
Outcome Expectancy			.20**	.20**
Action Self-Efficacy			.45***	.45***

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

Table 23

Correlations for Variables Used in Hierarchical Regression Analysis for Stage of Change-Exercise

Variable	1	2	3	4	5	6	7	8	9	10
1. Stage of Change-Exercise	--									
2. Age	-.02	--								
3. Education	.19**	.07	--							
4. Household Income	.27***	-.04	.28***	--						
5. Severity of Disability	-.21**	.26***	-.22**	-.39***	--					
6. Barriers	-.29***	.06	-.21**	-.35***	.51***	--				
7. Action Self-Efficacy	.35***	-.04	.16*	.21**	-.24***	-.46***	--			
8. Outcome Expectancy	.37***	-.07	.12*	.20**	-.32***	-.33***	.34***	--		
9. Risk Perception	.29***	.01	-.10	.11	-.02	-.13*	.27***	.43***	--	
10. Action Planning and Coping Planning-Exercise	.43***	.09	.11	.18**	-.12*	-.37***	.59***	.42***	.37***	--
11. Interaction between severity of disability and action self-efficacy	-.09	.25***	-.19**	-.32***	.89***	.37***	.11	.20**	.10	.09

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

Table 24

Hierarchical Regression Analysis for Prediction of Stage of Change-Exercise

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1***				
Age	.09	.09***	-.02	-.03
Education			.13	.10
Household income			.23**	.12
Step 2***				
Severity of Disability	.10	.01	-.11	-.01
Step 3***				
Barriers	.13	.03*	-.21*	-.03
Step 4***				
Action Self-Efficacy	.25	.12***	.17*	.06
Outcome Expectancy			.20**	.14
Risk Perception			.15*	.11
Step 5***				
Action Planning and Coping Planning-Exercise	.28	.04**	.26**	.26*
Step 6***				
Interaction between Disability and Action Self- Efficacy	.28	.00	-.02	-.02

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

Table 25

Correlations for Variables Used in Hierarchical Regression Analysis for Stage of Change-Exercise-Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9	10
1. Stage of Change-Exercise	--									
2. Age	-.02	--								
3. Education	.19**	.07	--							
4. Household Income	.27***	-.04	.28***	--						
5. Severity of Disability	-.21**	.26***	-.22**	-.39***	--					
6. Barriers	-.29***	.06	-.21**	-.35***	.51***	--				
7. Action Self-Efficacy	.35***	-.04	.16*	.21**	-.24***	-.46***	--			
8. Outcome Expectancy	.37***	-.07	.12*	.20**	-.32***	-.33***	.34***	--		
9. Risk Perception	.29***	.01	-.10	.11	-.02	-.13*	.27***	.43***	--	
10. Action Planning and Coping Planning-Exercise	.43***	.09	.11	.18**	-.12*	-.37***	.59***	.42***	.37***	--

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

Table 26

Hierarchical Regression Analysis for Prediction of Stage of Change-Exercise-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1***				
Age	.09	.09***	-.02	-.03
Education			.13	.10
Household income			.23**	.12
Step 2***				
Severity of Disability	.10	.01	-.11	-.02
Step 3***				
Barriers	.13	.03*	-.21*	-.03
Step 4***				
Action Self-Efficacy	.25	.12***	.17*	.05
Outcome Expectancy			.20**	.15
Risk Perception			.15*	.11
Step 5***				
Action Planning and Coping Planning-Exercise	.28	.04**	.26**	.26**

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

Table 27

Correlations for Variables Used in Hierarchical Regression for Physical Health

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Physical Health	--											
2. Age	-.28***	--										
3. Education	.05	.07	--									
4. Household Income	.06	-.04	.28***	--								
5. Severity of Disability	-.31***	.26***	-.22**	-.39***	--							
6. Barriers	-.06	.06	-.21**	-.35***	.51***	--						
7. Action Self-Efficacy	-.05	-.04	.16*	.21**	-.24***	-.46***	--					
8. Outcome Expectancy	.28***	-.07	.12*	.20**	-.32***	-.33***	.34***	--				
9. Risk Perception	.05	.01	-.10	.11	-.02	-.13*	.27***	.43***	--			
10. Action Planning and Coping Planning-Exercise	.00	.09	.11	.18**	-.12*	-.37***	.59***	.42***	.37***	--		
11. Stage of Change-Exercise	.08	-.02	.19**	.27***	-.21**	-.29***	.35***	.37***	.29***	.43***	--	
12. Interaction between severity of disability and action self-efficacy	-.35***	.25***	-.19**	-.32***	.89***	.37***	.11	-.20**	.10	.09	-.09	--

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

Table 28

Hierarchical Regression Analysis for Physical Health

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Age	.08	.08**	-.28***	-.20**
Education			.06	.03
Household income			.03	-.06
Step 2***				
Severity of Disability	.14	.06***	-.28***	-.00
Step 3***				
Barriers	.15	.01	.12	.12
Step 4***				
Risk Perception	.22	.07**	.00	.00
Outcome Expectancy			.27**	.26**
Action Self-Efficacy			-.16*	-.07
Step 5***				
Action Planning and Coping Planning Exercise	.22	.00	.03	.02
Step 6***				
Stage of Change Exercise	.22	.00	.02	.02
Step 7***				
Interaction Between Severity of Disability and Action Self-Efficacy	.23	.01	-.30	-.30

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

Table 29

Correlations for Variables Used in Hierarchical Regression for Physical Health- Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9
1. Physical Health	--								
2. Age	-.28***	--							
3. Education	.05	.07	--						
4. Household Income	.06	-.04	.28***	--					
5. Severity of Disability	-.31***	.26***	-.22**	-.39***	--				
6. Barriers	-.06	.06	-.21**	-.35***	.51***	--			
7. Action Self-Efficacy	-.05	-.04	.16*	.21**	-.24***	.46***	--		
8. Outcome Expectancy	.28***	-.07	.12*	.20**	-.32***	-.33***	.34***	--	
9. Risk Perception	.05	.01	-.10	.11	-.02	-.13*	.27***	.43***	--

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

Table 30

Hierarchical Regression Analysis for Physical Health-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Age	.08	.08**	-.28***	-.20**
Education			.06	.04
Household income			.03	-.06
Step 2***				
Severity of Disability	.14	.06***	-.28***	-.28**
Step 3***				
Barriers	.15	.01	.12	.10
Step 4***				
Risk Perception	.22	.07**	.00	.00
Outcome Expectancy			.27**	.27**
Action Self-Efficacy			-.16*	-.16*

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

Table 31

Correlations for Variables Used in Hierarchical Regression Analysis for Mental Health

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Mental Health	--											
2. Age	.12*	--										
3. Education	.09	.07	--									
4. Household Income	.20**	-.04	.28***	--								
5. Severity of Disability	-.19**	.26***	-.22**	-.39***	--							
6. Barriers	-.27***	.06	-.21**	-.35***	.51***	--						
7. Action Self-Efficacy	.19**	-.04	.16*	.21**	-.24***	-.46***	--					
8. Outcome Expectancy	-.12*	-.07	.12*	.20**	-.32***	-.33***	.34***	--				
9. Risk Perception	-.06	.01	-.10	.11	-.02	-.13*	.27***	.43***	--			
10. Action Planning and Coping Planning-Exercise	-.00	.09	.11	.18**	-.12*	-.37***	.59***	.42***	.37***	--		
11. Stage of Change-Exercise	.06	-.02	.19**	.27***	-.21**	-.29***	.35***	.37***	.29***	.43***	--	
12. Interaction between severity of disability and action self-efficacy	-.08**	.25***	-.19**	-.32***	.89***	.37***	.11	-.20**	.10	.09	-.09	--

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

Table 32

Hierarchical Regression Analysis for Mental Health

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Household income	.06	.06**	.19**	.11
Age			.13	.17*
Education			.03	-.01
Step 2**				
Severity of Disability	.08	.03*	-.18*	-.52*
Step 3***				
Barriers	.11	.03*	-.21*	-.25**
Step 4***				
Risk Perception	.18	.07**	-.02	-.01
Outcome Expectancy			-.28***	-.25**
Action Self-Efficacy			.15	.06
Step 5***				
Action Planning and Coping Planning Exercise	.20	.01	-.16	-.17
Step 6***				
Stage of Change Exercise	.20	.00	.04	.04
Step 7***				
Interaction Between Severity of Disability and Action Self-Efficacy	.22	.02*	.43*	.43*

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

Table 33

Correlations for Variables Used in Hierarchical Regression Analysis for Mental Health-Parsimonious Model

Variable	1	2	3	4	5	6	7	8	9	10
1. Mental Health	--									
2. Age	.12*	--								
3. Education	.09	.07	--							
4. Household Income	.20**	-.04	.28***	--						
5. Severity of Disability	-.19**	.26***	-.22**	-.39***	--					
6. Barriers	-.27***	.06	-.21**	-.35***	.51***	--				
7. Action Self-Efficacy	.19**	-.04	.16*	.21**	-.24***	-.46***	--			
8. Outcome Expectancy	-.12*	-.07	.12*	.20**	-.32***	-.33***	.34***	--		
9. Risk Perception	-.06	.01	-.10	.11	-.02	-.13*	.27***	.43***	--	
10. Action Planning and Coping Planning-Exercise	-.00	.09	.11	.18**	-.12*	-.37***	.59***	.42***	.37***	--

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

Table 34

Hierarchical Regression Analysis for Mental Health-Parsimonious Model

			At Entry into Model	Final Model
Variable	R^2	ΔR^2	β	β
Step 1**				
Household income	.06	.06**	.19**	.12
Age			.13	.18*
Education			.03	-.02
Step 2**				
Severity of Disability	.08	.03*	-.18*	-.12
Step 3***				
Barriers	.11	.03*	-.21*	-.23**
Step 4***				
Risk Perception	.18	.07**	-.02	.01
Outcome Expectancy			-.28***	-.25**
Action Self-Efficacy			.15	.22*
Step 5***				
Action Planning and Coping Planning Exercise	.20	.01	-.16	-.16

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

BIOGRAPHICAL SKETCH

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EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
The University of Kansas The University of Texas Southwestern Graduate School of Health Professions	B.G.S. M.R.C.	2010 2013	Psychology, Business Minor Rehabilitation Counseling Psychology

Positions and Employment

2013-Present Dr. Matthew Housson and Associates- Academic Coach

Clinical Experience

February 2013-August 2013 UT Southwestern Developmental Neuropsychology-Assessment Intern

August 2012-February 2013 UT Southwestern Personal and Social Adjustment Training Group Counseling- Group Co-Facilitator and Counseling Intern

Research Experience

2008 The Univeristy of Kansas-Social Psychology Research Assistant

2011-2013 UT Southwestern- Thesis Research