# A PROPOSED BATTERY USED TO MONITOR TREATMENT OUTCOMES IN INDIVIDUALS WITH MULTIPLE SCLEROSIS: A CASE STUDY

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DEDICATION

I would like to thank the members of my Graduate Committee for their guidance and patience through this process. I would also like to thank my family and friends for their ongoing encouragement and support. Finally, I would like to thank the entire faculty in the Department of Rehabilitation Counseling for all their help and effort to ensure my success.

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by

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THESIS

Presented to the Faculty of the School of Health Professions

The University of Texas Southwestern Medical Center

Dallas, Texas

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF REHABILITATION COUNSELING

Abstract

BACKGROUND: Multiple Sclerosis (MS) is a chronic disease of the central nervous system. As of now, there is no cure for MS, but different forms of treatment have been studied to ameliorate both physical and psychosocial symptoms. Numerous measures have been used within the MS population to monitor symptoms before, during, and after treatment. The aim of this present study was to ensure the usefulness of a battery of outcome measures that will assess MS-related symptoms before and after standard treatment. Another aim of the study was to assess treatment outcomes and determine the current success of each individualized treatment plan.

SUBJECTS: All participants had a confirmed diagnosis of MS, were able to read and write in English, were 18 years of age and older, and able to walk, even briefly, with or without an assistive device. Participants were recruited through The University of Texas Southwestern Medical Center, Multiple Sclerosis Clinic.

METHOD: Ten qualified MS patients were given a Six-minute walk test, two cognitive tests, and nine psychosocial measures as a baseline assessment. After six to eight weeks of Standard care, all participants were asked to return in order to complete all the measures again. It was hypothesized that the proposed battery of measures would prove to be useful in monitoring treatment outcomes in patients with MS. It was also hypothesized that individualized treatment would prove to be beneficial to each participant over the course of the study.

RESULTS: This study did not provide any evidence that the individualized treatment was beneficial. Moreover, it did not provide any evidence that this particular battery was sensitive enough to truly monitor treatment outcomes. There was only one significant difference found

between initial and follow-up assessment. The sum of ranks for the BORG was 0.00 ($Z$ = -2.00, $p$ = .046, $r$ = -0.89) when comparing breathlessness scores. This indicates that individuals that returned for follow-up assessment experienced less breathlessness at follow-up assessment before and after the Six-minute Walk Test than before and after the Six-minute Walk test upon initial assessment.

DISCUSSION: The period between assessments may not have been long enough to identify any changes in treatment or treatment outcomes. Due to the unpredictable nature of MS, it may be important for providers to assess individuals using a comprehensive, biopsychosocial battery on a case-by-case basis rather than a generalized pre-established time frame.

*Keywords:* Multiple Sclerosis, assessment, comprehensive battery, biopsychosocial, treatment outcomes.

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# LIST OF ABBREVIATIONS

MS – Multiple Sclerosis

CNS – Central Nervous System

RRMS – Relapsing Remitting Multiple Sclerosis

PPMS – Primary Progressive Multiple Sclerosis

SPMS – Secondary Progressive Multiple Sclerosis

PRMS – Progressive Relapsing Multiple Sclerosis

# CHAPTER ONE

## Introduction

## A Proposed Biopsychosocial Battery Used to Monitor Treatment Outcomes in Individuals with Multiple Sclerosis: A Case Study

Multiple sclerosis (MS) is a chronic and progressive disorder of the central nervous system (CNS). It is characterized by inflammation, demyelination and axonal loss causing neurological disability. The distribution of the damage can be variable, causing deficits essentially anywhere in the CNS (Rietberg, Brooks, Kwakkel, & Uitdehaag, 2005). The National MS Society (2011) has recognized four different courses or subtypes of the disease: relapse-remitting; primary progressive; secondary progressive; and progressive relapsing. Relapse Remitting MS is characterized by attacks of worsening neurological function (exacerbations) and periods of recovery (remissions). Primary Progressive MS is marked by slowly worsening neurological function, with no notable periods of remission. Secondary Progressive MS worsens more steadily, and may or may not include periods of remission. Progressive Relapsing MS, a more rare sub-type, is characterized by steadily worsening of the disease without clear remissions. Each subtype of MS can be classified as mild, moderate, or severe (The National MS Society, 2011). It has been estimated that 400,000 people in the United States, and 2.5 million people worldwide, have a diagnosis of MS (Cosio, Jin, Mohr & Siddique, 2011). Age of onset is typically during early adulthood, and MS has been shown to affect more women than men (Chalder, Dennison, & Moss-Morris, 2009). Much of the current research on MS focuses on pathophysiology, treatment, and management of symptoms (Forbes, Taylor, & While, 2007). Immunomodulating therapies are being used more to affect the clinical course of

the disease, but currently no cure exists for MS. The emphasis of current treatment is therefore on improving quality of life and increasing daily functioning (Baker, Galvin, Hillier, Thomas & Thomas, 2006).

Due to the wide ranging effects of MS, individuals can experience physical, cognitive, psychological and social impediments. Reduced functioning and mobility are common limitations in individuals with this neurological disease, and it can hinder performance of activities of daily living (JoseSa, 2008). MS is also associated with depression, fatigue, and diminished quality of life (Dalgas, et. al, 2010). Cognitive dysfunction should also be considered in MS patients. Current clinical research reports prevalence rates of cognitive dysfunction due to MS between 40 and 70% (Langdon, 2011).

Fatigue is one of the most common symptoms affecting those with MS (Johnson, 2008). Furthermore, there is evidence that anxiety is associated with MS. Literature has shown a prevalence of anxiety in MS patients, with a wide range of 19% to 90% (JoseSa, 2008). Current research has also explored different forms of physical therapy for managing MS, including endurance or aerobic training and strength or resistance training. Other investigations have considered psychosocial interventions such as Cognitive Behavioral Therapy (CBT), relaxation therapy, and different forms of individual and group counseling.

There is a paucity of research that has simultaneously examined multiple treatment outcomes, using outcome measures that have solid psychometric properties specifically validated for use among people with MS. Due to the large scale of symptoms common in MS, it is important to evaluate various measures in order to develop a more comprehensive, biopsychosocial evaluation of symptoms and treatment oucomes. The aim of this present study

was to ensure the usefulness of a battery of outcome measures that will assess MS-related symptoms before and after standard treatment. Another aim of the study was to assess treatment outcomes and determine the current success of each individualized treatment plan. The battery used in this present study includes measures that are traditionally used in the MS population as well as newly selected measures. These particular measures were chosen in an effort to cover some of the more prevalent biopsychosocial symptoms that individuals with MS suffer from regardless of the MS subtype.

# CHAPTER TWO

## Review of the Literature

### Biopsychosocial Symptoms Associated with MS

Depression is commonly seen in patients with MS, and it has been associated with quality of life, physical functioning, and social functioning. Kirchner (2011) conducted a study analyzing the extent to which impaired physical and social functioning may explain symptoms of depression. The extent to which the loss of social functioning acting as a mediator between depression and stress associated with MS was also evaluated. Sixty-five participants, previously diagnosed with MS were recruited from various MS centers. It was found that the decrease in social functioning had greater power in predicting depression symptoms than did the loss of physical functions. More than one-half (52%) of MS patients with depression symptoms perceived loss of social function. MS perceived stress was positively correlated with depression symptoms ($r$=0.369, $P$<0.01), and negatively with scores on the social functional scale ($r$=-0.314, $P$<0.05). Social functioning was negatively correlated with depression symptoms ($r$=-0.659, $P$<0.001). Physical functioning did not correlate with perceived stress, social functioning, or depression symptoms ($P$>0.05). This research provides evidence of a strong relationship between perceived lack of social functioning and depression in individuals with MS. This research may also have important implications for measuring MS symptoms from a biopsychosocial standpoint when developing treatment programs in an effort to improve quality of life.

It is not uncommon for patients with MS to experience neuropsychiatric complications throughout the course of the illness (Bruce & Arnett, 2008). A paucity of research has been

conducted to examine the clinical correlates between anxiety and MS. The most common of the anxiety disorders related to MS is generalized anxiety disorder (GAD) (Bruce & Arnett, 2008). Bruce and Arnett (2008) describe chronic worry as the defining feature of generalized anxiety. They used this idea to develop a study examining the clinical correlates of generalized worry in MS. They collected data from a total of 50 patients with definitive or probable diagnoses of MS. All participants were given a variety of measures assessing physical, cognitive, and emotional functioning. They found that elevated worry was associated with fatigue, sleep disturbance, problem-solving deficits, pain, and disability status. Elevated worry was also associated with higher rates of depression ($r$=.55, $p$<.001), trait anxiety ($r$=.64, $p$<.001) and state anxiety ($r$=.46, $p$<.01). Further analyses shows excessive worry to be associated with higher rates of disability ($r$=.30, $p$<.05), sleep disturbance ($r$=.45, $p$<.01), social fatigue ($r$=.40, $p$<.01), and pain interference ($r$=.42, $p$<.01). It was also found that excessive worry was associated with poor reasoning and problem solving ($r$=-.44, $p$<.001). The authors urge clinicians to regularly monitor and treat worry in patients with MS, thus, indicating the need for adequate measures of anxiety and associated symptoms.

Motl and McAuley (2010) examined symptom clusters (fatigue, pain, and depression) as a correlate of diminished quality of life. They described quality of life as an individual's overall judgment regarding satisfaction with life. The sample in this study included 291 individuals with a definite diagnosis of MS. Participants were given baseline measures of fatigue, depression, and pain. They were given follow-up measures of quality of life (QoL). After identifying three subgroups of individuals on the basis of experiences with fatigue, pain, and depression, they found ninety-three participants scoring high on all three measures. They found that the subgroup

with the highest scores on the symptom measures had the most diminished QoL according to the two QoL measures used (Leed's MS Quality of Life Scale and the Satisfaction with Life Scale), with a mean QoL score of 26 and 16, respectively. These findings provide preliminary support that fatigue, pain, and depression correlate with QoL in individuals with MS. The assessment of fatigue, pain, and depression may be important in predicting quality of life.

This general idea of quality of life may not be the only threat to individuals suffering from a chronic illness. When faced with chronic illness, psychosocial well-being may be threatened (Romagosa, 2001). In order to help individuals with MS cope effectively, it is important to understand how they attempt to cope or adapt to their health status. Chronic illness forces people to adapt to different living and health conditions (Romagosa, 2001). Psychological coping has proved to be crucially important for adjusting to the demands that chronic illness introduces (Goretti, Portaccio, Zipoli, Razzolini, & Amato, 2010). In a study conducted by Lode, Bru, Klevan, Myhr, Nyland and Larsen (2010), coping styles among patients with MS were not as adaptive as "healthy individuals". They examined how coping styles among patients with MS change over time, and how coping styles after five years were associated with the need for disability pension. Data was collected from seventy-six patients that were diagnosed with definite or probable MS. These individuals completed the COPE scale at baseline and at a five-year follow-up. Patients were also given a neurological examination and the Beck Depression Inventory. Results revealed no indication of significant changes between baseline and five-year follow-up for depression or cognition. However, patients' coping styles were significantly lower than healthy controls. The overall results on avoidance coping did not change from baseline to five-year follow-up. The proportion of patients awarded the disability pension increased from

51% at baseline to 73% at 5-year follow up. This study suggests a tendency for patients with MS to use coping styles that may not be adequate, and do not necessarily improve over time. Findings do suggest that there may be a potential for improving the lives of patients with MS via interventions used to enhance coping skills when dealing with the disease.

Cognitive impairment is also a clinical feature of MS and research has shown cognitive disturbances to have a great impact on the activities of daily living which affect quality of life in MS patients (Caceres, Vanotti, Rao, & the RECONEM Work group, 2011). In a review on cognitive impairment by Julian (2011), it was noted that approximately one-half of patients who are diagnosed with MS will develop cognitive dysfunction (between 40% and 65%). Cognitive impairment can be debilitating for individuals with MS, as well as costly. It has been widely researched and understood that cognitive impairment can cause diminished quality of life, diminished daily function, decreased capacity in medical decision making, and can contribute to loss of work. Unfortunately, empirically validated treatments for cognitive impairment are scarce (Julian, L., 2011). The most common manifestations of cognitive dysfunction are deficits in processing speed, episodic memory, working memory, executive functioning and retrieval (Julian, 2011). Thus, a routine screening for cognitive impairment may be important in monitoring symptoms in patients with MS.

The measures used in this present study assessed anxiety, depression, physical and perceived disability, resilience, coping skills, fatigue, pain, quality of life, cognitive impairment and the impact of MS, using a Six-minute Walk Test in conjunction with a perceived exertion assessment, two cognitive measures, and nine psychosocial measures. The selected outcome measures were the following: the State-Trait Anxiety Inventory; the Beck Depression Inventory;

the Fatigue Severity Scale; the Six-Minute Walk Test (including the BORG scale); the SF-12; the Brief COPE; the Pain Disability Questionnaire; the Connor-Davidson Resilience Scale-10; the Multiple Sclerosis Impact Scale-29; the Delis-Kaplan Executive Function System- a trail making test; and the Hopkins Verbal Learning Test-Revised. Although each measure has proved to be psychometrically sound (see Methodology), not all of the measures have been validated in the MS population. It is hypothesized that the proposed battery will prove to be useful in monitoring treatment outcomes. It is also hypothesized that individualized treatment would prove to be beneficial to each participant over the course of the study.

# CHAPTER THREE

## Method

### Subjects

Male and female adults (18 and older) with MS were recruited from the UT Southwestern Multiple Sclerosis Clinic, Department of Neurology as well as from the community. A power analysis revealed that 200 participants were needed for an appropriate psychometric evaluation. Due to time restraints and lack of participant motivation, the sample size was much smaller than anticipated (N = 10). All participants had a definite diagnosis of MS, no matter the subtype, from a neurologically-trained physician, and were ambulatory with or without assistive devices. Demographic information, such as age, sex, ethnicity, time elapsed since diagnosis, MS specific medications taken, and MS subtype, were collected from each participant.

### Procedure

All participants were assessed for eligibility and given written informed consent. The full battery of assessment measures were administered to participants as a baseline assessment. After between 6-8 weeks of standard care/treatment, participants were asked to return and complete the full battery again. Order of administration of the nine psychosocial measures was randomized in an effort to avoid order effect.

### Standard Care

All participants continued to receive Standard Care from all providers they were seeing prior to participation in the study. Standard Care included medication, patient home health services when appropriate, physical therapy, psychosocial and counseling services, occupational and vocational services, exercise, and monitoring the usage of assistive devices. None of the

participants was asked to deviate from Standard Care, and were not advised to restrict any of their activities. Interventions used in Standard Care were monitored throughout the study.

**Instruments and Outcome Measures**

*The Pain Disability Questionnaire* (PDQ; Anagnostis, Gatchel, & Mayer, 2004). The PDQ was developed to measure clinical outcomes in pain patients suffering from chronic musculoskeletal disorders, with a primary focus on disability and function. The PDQ is a 15-item measure that instructs the reader to respond on a 10-point scale for each item in question (0 = no interference, 10 = complete interference). The PDQ produces a total functional disability score that ranges from 0-150. The PDQ has excellent psychometric properties, with strong test-retest reliability coefficients, ranging from 0.94 to 0.98, and a Chronbach's alpha coefficient of 0.96. Cohen's effect size ranged from .85 to 1.07. Construct-related validity correlated well with other physical and psychosocial measures of functional status (Anagnostis, Gatchel & Mayer, 2004).

*Beck Depression Inventory-2nd Edition* (BDI-II; Beck, Steer & Brown, 1996). The BDI-II is a self-report inventory containing 21 multiple-choice items. It was designed to assess depression according to the DSM-IV, in adolescents as well as adults (Harris & D'Eon, 2008). It is a revision of the original BDI developed by Beck & Steer in 1993. The BDI-II provides one, overall score that ranges from 0-63. Normal or minimal scores range from 0-13. Scores ranging from 14-19 may indicate mild depressive symptomology. Mild to moderate depression symptoms are represented by scores 20-28. Moderate and severe depression symptoms should be considered when scores range from 29-63. When evaluating the psychometric properties of the BDI-II, researchers found a coefficient alpha for psychiatric outpatients and college students at .92 and .93, respectively. Test-retest correlation was significant at .93 ($p < .001$), with a first assessment mean of 20.27 (SD = 10.46), and a second assessment mean of 19.42 (SD = 10.38).

Construct validity of the BDI-II correlated well with the previous version of the BDI (BDI-IA) at .93 ($p < .001$). Their research also demonstrated good reliability, with a range of .15-.50.

*State-Trait Anxiety Inventory Form Y* (STAI; Spielberger, Gorsuch, Lushene, & Vagg, 1983). The STAI Form Y is a measure of State and Trait Anxiety in individuals. There are 20 items for measuring State Anxiety, and 20 items for measuring Trait Anxiety. Each item is rated on a four- point scale, from "Almost Never" to "Almost Always". Higher scores indicate more distress or anxiety. The STAI yields good test-retest reliability. For the Trait Anxiety scale, when used with college and high school students, the mean reliability coefficients were .765 and .695, respectively. For the State Anxiety scale, coefficients ranged from .16 to .62, which is expected for ratings of state anxiety. Both scales demonstrated good internal consistency, with coefficients ranging from .86 to .95 (S-Scale .93, T-Scale .90). Construct-related validity correlated well with other measures of anxiety, with correlation coefficients ranging from .85 to .73 depending on the measure (Spielberger, Gorsuch, Lushene, & Vagg, 1983).

*Six-Minute Walk Test* (6MWT; Guyatt et al., 1985). The Six-Minute Walk Test is used to measure functional capacity by assessing the distance patients are able to walk without being motivated. Patients are instructed to walk for a period of six-minutes on a hard flat surface. Patients choose their own intensity and are allowed to rest during the test if needed. Studies have used corridors ranging from 20 to 50 meters (American Thoracic Society, 2002). The 6MWT has strong test-retest reliability ($r$=0.95) and validity ($r$=.58) (Mungall & Hainesworth, 1979).

*Rating of Perceived Exertion: The BORG Scale* (RPE; Borg, G., 1998). The Borg Scale or RPE is to be used in conjunction with the six-minute walk test. Before the walk test begins, the examiner should ask the subject to "Please grade your level of shortness of breath using this

scale." Then the examiner is to ask the subject to "Please grade your level of fatigue using this scale." The scale is a rating of 0-10 (0-nothing at all, 10-very, very severe). After the walking test, the scale is presented to the subject again, and both of the previous questions are asked again. Research by Chen, Fan, and Moe (2002) reported high validity ratings (*r=0*.80-0.90) under certain conditions. Research suggests further psychometric evaluation is necessary.

*Multiple Sclerosis Impact Scale-29* (MSIS-29; Hobart, Lamping, Fitzpatrick, Riazi, & Thompson, 2001). The MSIS-29 is a self-report scale developed to measure the psychological and physical impact of MS. The Scale consists of 29 items, with a rating scale from "Not at all" to "Extremely". Recent research has confirmed the good psychometric properties of the originally developed scale. Scores have shown high internal consistency, with a Chronbach's alpha of .97, rating physical impact, and a Chronbach's alpha of .92, for rating psychological impact. Test-retest reliability was also found to be acceptable ($r$ = 0.65-0.90) (Gray, Hawkins, & McDonnell, 2008).

*Fatigue Severity Scale* (FSS; Krupp, LaRocca, Muir-Nash, & Steinberg, 1989). The FSS is a self-report measure consisting of nine items, using a seven point rating scale. Each of the items is related to daily activities. Individuals indicate their level of agreement or disagreement with the given statement (1 indicates "strongly disagree" and 7 indicates "strongly agree"). Recent research by Valko, Bassetti, Bloch, Held, and Baumann (2008) suggests the FSS maintains good internal consistency and reliability (Chronbach *a*=.93). Test-retest was assessed and provided evidence of stable values over time (2.94 +/- 0.90 vs. 2.90 +/- 0.74) (Valko, Bassetti, Boch, Held, & Baumann, 2008).

*Short Form-12* (SF-12; Ware, Kosinski, & Keller, 1996). The SF-12 is a medical

outcomes questionnaire created to assess quality of life and health. It was originally constructed for the RAND Medical Outcomes Study that assessed patients with chronic conditions. The 12 items measure different health concepts and contain a physical and a mental component. Items use varying point scales (2 to 6 points). Validity estimates for the physical component on the SF-12 range from 0.43 to 0.93 (median of 0.67). Validity estimates for the mental component ranged from 0.60 to 107 (median=0.97) (Ware, Kosinski & Keller, 1996).

*Brief COPE* (Carver, 1997). Derived from the original COPE inventory (Carver, Scheier, & Weintraub, 1989), the Brief Cope measures the coping style of individuals. This 28-item measure uses a 4-point Likert scale. The three coping strategies measured are; problem-focused coping; active emotional coping; and avoidant emotional coping. Higher scores indicate greater intensity regarding personal use of each coping strategy. The measure includes 14 subscales, with 2 items each. Coefficient alphas of the subscales range from .50 to .90 (Carver, 1997).

*Connor-Davidson Resilience Scale-2* (CD-RISC2; Vaishnavi, Connor, & Davidson, 2007). This CD-RISC-2 is a measure of resilience, which has been defined by Connor and Davidson as the personal qualities that enable one to thrive in the face of adversity. This abbreviated version of the CD-RISC is a self-report measure consisting of two factor items (adaptability to change and tendency to bounce back after hardship). The CD-RISC2 has been shortened from the original 25-item measure to a 10-item measure. The scale requires subjects to rate how much they agree with 10 statements as they apply over the last month on a scale from 0-4 (0-"not true at all", 4-"true nearly all of the time") (Vaishnavi, Connor, & Davidson, 2007). In a test of psychopharmalogical utility, intraclass correlation between groups was 86.5% ($P<0.0001$), suggesting good test-retest reliability. Furthermore, when compared with the CD-

RISC, it was observed that the CD-RISC2 showed significant correlations with each individual item (ranging from $r$=0.27 *to* $r$=0.66*)* (Vaishnavi, Connor, & Davidson, 2007).

*Delis-Kaplan Executive Function System: Trail Making Test* (D-KEFS; Delis, Kaplan, & Kramer, 2001). The D-KEFS Trail Making Test measures an individuals' executive functioning skills. The measures consist of five conditions: 1. Visual Scanning; 2. Number Sequencing; 3. Letter Sequencing; 4. Number-Letter Switching; and 5. Motor Speed. The primary executive-function task is the Number-Letter Switching condition, which measures flexibility of thinking under timed conditions. The D-KEFTS provides information about the subjects' visual motor processing speed, impulsivity, and flexibility of thinking in a non-verbal problem-solving format (Swanson, 2005). Internal consistency values were based on different age groups. Researchers developed a composite score for number and letter sequencing for each of these age groups. Scores for ages 20-89 ranged from .74 to .81. Without the use of alternate forms, test-retest coefficients were found to be in the low to moderate range. From Condition 1 to Condition 5, test-retest coefficients are as follows: .56, .59, .59, .38, and .66 (Delis, Kaplan, & Kramer, 2001).

*Hopkins Verbal Learning Test-Revised* (HVLT-R; Brandt & Benedict, 1998). The HVLT-R is a 12-item word list that yields scores for total recall ability, delayed recall ability, a retention percentage, and recognition discrimination ability. The HVLT-R has six different forms, each with different words lists. The first three trials assess learning ability. The fourth trial assesses delayed recall ability. The fifth trial assesses an individuals' ability to discriminate between words from the original list and new words. Test-retest reliability coefficients for the four primary variables are as follows: Total Recall: $r = .74$, $p < .001$; Delayed Recall: $r = .66$, $p < .001$; Retention %: $r = .39$, $p < .05$; and Recognition Discrimination: $r = .40$, $p < .05$ )

(Benedict, Schretlen, Groninger, & Brandt, 1998).

# CHAPTER FOUR

## Results

### All Participants

A total of ten patients with official diagnoses of MS [8 female (80%); 2 male (20%)] participated in the present study. All participants were under the care of a neurologist before and during the study. Eight (80%) individuals had been diagnosed with Relapse Remitting MS (RRMS), one (10%) individual was diagnosed with Primary Progressive MS (PPMS), and one (10%) individual was diagnosed with Secondary Progressive MS (SPMS). Ages ranged from 27-65 ($M$ = 42.70, $SD$ = 13.34). Seven (70%) of the 10 participants identified themselves as white/European American, and three (30%) out of the 10 participants identified themselves as African American. A body mass index (BMI) was calculated for all participants, which yielded an average of 27.41 ($SD$ = 6.41, range = 20.40-41.20), indicating that the majority of participants fell within the overweight range [three (30%) normal, 4 (40%) overweight, 3 (30%) obese]. A waist-to-hip ratio was also calculated for all participants. The mean waist-to-hip ratio was .81 ($SD$ = .08, range = .72-.97), which placed 30% of the participants into an unhealthy range and 70% of the participants into a healthy range. Years since MS onset were calculated for each individual, with a wide range of one year to 24 years ($M$ = 8.05, $SD$ = 6.96). Primary MS medication was also recorded [6 (60%) Tysabri, 2 (20%) Avonex, 1 (10%) Cellcept, and 1 (10%) Copaxone]. All participants were covered under insurance [7 (70%) by private insurance through employment, 3 (30%) receive Medicare]. Nine (90%) participants endorsed having other health problems [4 (40%)] high blood pressure, 4 (40%) undefined health problems, 1 (10%) over weight, 1 (10%) no other health problems] [see Table 1].

**Treatment demographics.** All types of treatment specific to MS were recorded for each individual. All ten participants (100%) had received medical treatment from a neurologist (range = 1-20 years, *M* = 7.65, *SD* = 5.99). Four (40%) of the participants endorsed receiving physical therapy, which was recorded in months (range = 1-36 months, (*M* = 11.75), *SD* = 16. 29). One participant endorsed receiving occupational therapy for a period of one month. Sixty percent endorsed engaging in personal exercise in months (range = 6-11, *M* = 35.17, *SD* = 47.96). One participant (10%) reported receiving psychosocial assessment, and one individual reported receiving vocational assessment. One (10%) individual reported receiving individual counseling for a period of one month at the time of the study. Two (20%) of the participants received vocational training daily for a one-week period. More detailed demographic information was recorded and is reported below, depending on whether they returned for a follow-up evaluation or were only available for a baseline assessment [see Table 2].

**Follow up-Cases**

**Patient demographics.** Five (male, *n* = 1; female, *n* = 4*)* of the ten participants were able to schedule and return for a follow-up assessment. Of these five, four (80%) were diagnosed with Relapsing Remitting MS (RRMS), and 1 (20%) was diagnosed with Secondary Progressive MS (SPMS). From this group, ages ranged from 27-65 (*M* = 44.00, *SD* = 17.21). The BMI for this sample of participants ranged from 20.40 to 26.90 (*M* = 23.20, *SD* = 2.76), indicating that three (60%) of the individuals fell into a healthy range and two (40%) were considered overweight. The mean waist-to-hip ratio was .81 (*SD* = .08, range = .73-.92). Only one of the participants was considered unhealthy according to this standard. An average of 9.40 was established for years since onset (range = 1-24, *SD* = 8.79). Two (40%) of this group were

taking Avonex as their primary MS medication, and three (60%) were taking Tysabri. Four (80%) were covered by insurance through their employer, and 1 (20%) was covered by Medicare. Other health problems were endorsed by two of the participants, who both described suffering from high blood pressure. The other three participants did not report any other health issues [see Table 1].

**Treatment demographics.** Treatment, specific to MS, was recorded for all five follow-up participants. Each participant had been under the care of a neurologist for varying periods of time (range = 1-20 years, $M$ = 8.60, $SD$ = 7.16). This sample reported seeing their neurologist at an average of every 5.80 months, with a range of once a month to once a year ($SD$ = 4.02). None of the participants in this sample had received physical therapy or occupational therapy prior to, or during, the study. Three of the participants reported personal exercise (twice a week, $n$ = 2; three times a week, $n$ = 1). Each of the participants involved in personal exercise described different forms of physical activity (aquasize, $n$ = 1; treadmill, $n$ = 1; walking and lifting weights, $n$ = 1). One participant reported receiving vocational training, daily for a period of one week [see Table 2].

**Descriptive statistics of measures.** In addition to general descriptive statistics of measures, a non-parametric, Wilcoxon signed-ranks was computed in order to compare scores between baseline and the follow-up assessment for each of the measures. Only one significant difference was found (BORG: Breathlessness) between baseline and follow-up assessment.

The Fatigue Severity Scale (FSS) yielded a mean total of 38.60 (range = 30.00-49.00, $SD$ = 7.50) at baseline assessment. The FSS follow-up total had a mean of 38.00 (range = 29.00-

39.00, *SD* = 10.09). The FSS yielded a sum of ranks of 3.00 (*Z* = -0.74, *p* = .461). These results indicate no differences between scores from initial assessment to follow-up assessment.

The Pain Disability Questionnaire (PDQ) yields scores for functional disability, as well as psychosocial disability. The mean for functional disability at baseline was 11.40 (range = 0.00-47.00, *SD* = 20.05). The mean for functional disability at follow-up assessment was 11.20 (range = 0.00-41.00). The total mean for psychosocial items on the PDQ at baseline was 6.80 (range = 0.00-27.00, *SD* = 11.47). The total mean for psychosocial items at follow up was 6.20 (range = 0.00-28.00, *SD* = 12.21). Total scores for the PDQ were calculated at baseline (*M* = 18.20, range = 0.00-74.00, *SD* = 31.49), and follow-up (*M* = 17.40, range = 0.00-69.00, *SD* = 29.27). Results for the PDQ did not produce differences for the functional, psychological, or total scores (Functional: T = 1.00, *Z* = -0.45, *p* = .655) (Psychological: T = 1.00, *Z* = -0.45, *p* = .665) (Total: T = 2.50, *Z* = -0.27, *p* = .785).

The total mean score for the Brief Cope (BC) was 2.47 (range = 2.29-2.86, *SD* = .23) at baseline. At follow-up assessment, the total mean was 2.37 (range = 2.18-2.75, *SD* = .22). The sum of ranks for the BC was 2.00 (*Z* = -1.48, *p* = .138). This indicated that there was no significant difference between initial and follow-up assessment.

The State Trait Anxiety Inventory (STAI) yields scores for both state anxiety and trait anxiety. The baseline mean score for state anxiety was 34.80 (range = 21.00-49.00, *SD* = 13.19). The follow-up mean score for state anxiety was 29.60 (range = 20.00-37.00, *SD* = 6.30). The baseline mean score for trait anxiety was 45.60 (range = 36.00-57.00, *SD* = 8.93). The follow-up mean score for trait anxiety was 42.40 (range = 32.00-57.00, *SD* = 9.98). Results for the STAI

did not differ on either the state or trait scores (State: T = 4.00, $Z$ = -0.94, $p$ = .345) (Trait: T= 1.00, $Z$ = -1.47, $p$ = .141).

The Multiple Sclerosis Impact Scale (MSIS-29) yields total scores for physical impact as well as psychological impact. The mean score for physical impact was 38.00 (range = 25.00-81.00, *SD* = 24.8) at baseline assessment. The mean score for physical impact was 36.80 (range = 26.00-71.00, *SD* = 19.33) at follow-up assessment. The mean score for psychological impact at baseline assessment was 21.40 (range = 13.00-28.00, *SD* = 6.26). The mean score for psychological impact at follow-up assessment was 20.80 (range = 16.00-30.00, *SD* = 5.63). Results for the MSIS-29 did not produce any differences for either the psychological or physical factors (Psychological: T = 6.00, $Z$ = -0.41, $p$ = .684) (Physical: T = 7.00, $Z$ =-0.14, $p$ = .892).

The Beck Depression Inventory (BDI-II) total mean score at baseline was 14.10 (range = 4.00-20.00, *SD* = 6.69). The total mean score at follow-up assessment was 12.70 (range = 7.00-19.50, *SD* = 4.59). The BDI-II produced a sum of ranks of 5.00 ($Z$ = -0.67, $p$ = .500).

The Connor Davidson Resiliency Scale (CDRS-R) total mean at baseline was 28.80 (range = 23.00-32.00, *SD* = 3.49). The total mean at follow-up was 27.60 (range = 27.00-30.00, *SD* = 1.34). The CDRS-R produced a sum of ranks of 4.50 ($Z$ = -0.83, $p$ =.408), indicating no significant differences from initial to follow-up assessment.

The Short Form 12 (SF 12) yields a total mean score for physical factors and mental factors. The mean for physical factors at baseline was 48.18 (range = 28.47-61.62, *SD* = 13.09). The mean for physical factors at follow-up was 47.25 (range = 30.09-58.48, *SD* = 10.41). The mean for mental factors at baseline was 41.68 (range = 21.90-53.48, *SD* = 12.73). The mean for mental factors at follow-up was 43.01 (range = 20.15-53.73, *SD* = 13.45). Results for the SF-12

did not produce any differences for either the physical or psychological factors (Physical: T = 6.00, $Z$ = -0.41, $p$ = .686) (Psychological: T = 5.00, $Z$ = -0.67, $p$ = .500).

The total mean score for the International Physical Activity Questionnaire (IPAQ) at baseline was 52.27 (range = 11.55-128.40, *SD* = 53.53). The total mean score at follow-up was 41.24 (range = 12.00-112.40, *SD* = 47.65). The sum of ranks for the IPAQ was 2.00 ($Z$ = 2. 00, $p$ = -1.10).

The Six Minute Walk Test (6MWT) had a mean distance of 1,335.60 feet (range = 533-1,885, *SD* = 512.29) at baseline assessment. A mean distance of 1,384.20 feet (range = 660-2,015, *SD* = 483.48) was calculated at follow-up assessment. The sum of ranks for the 6MWT was 3.00 ($Z$ = -1.21, $p$ = .225).

The Rating of Perceived Exertion (BORG) yielded four means for both baseline and follow-up assessment: Breathlessness before the 6MWT (Baseline: *M* = .10, range = 0.00-0.22, *SD* = .22) (Follow-up: *M* = .50, range = 0.00-1.00, *SD* = .50); Fatigue before the 6MWT (Baseline: *M* = .30, range = 0.00-0.50, *SD* = .27) (Follow-up: *M* = 1.5, range = 0.00-4.00, *SD* = 1.58), Breathlessness after the 6MWT (Baseline: *M* = 1.50, range = 0.50-2.00, *SD* = .70) (Follow-up: *M* = 1.30, range = 0.50-2.00, *SD* = .67); and Fatigue after the 6MWT (Baseline: *M* = 1.30, range = 0.50-2.00, *SD* = .67) (Follow-up: *M* = .1.10, range = 0.50-2.00, *SD* = .54). The only significant difference found was between initial assessment and follow-up assessment of the BORG. The sum of ranks for the BORG was 0.00 ($Z$ = -2.00, $p$ = .046, $r$ = -0.89) when looking at breathlessness scores and 6.50 ($Z$ = -0.27, $p$ = .786) when looking at fatigue scores.

Means for the five different conditions were calculated for both baseline and follow-up assessments for The Delis-Kaplan Executive Function System: Trail Making Test (DKEFS-

TMT). Condition 1 (Visual Scanning) had a mean of 8.60 (range = 3-14, *SD* = 4.82) at baseline and a mean of 9.00 (range = 5-13, *SD* = 3.53) at follow-up. Condition 2 (Number Sequencing) had a mean of 9.80 (range = 6-13, *SD* = 3.11) at baseline and a mean of 10.40 (range = 9-13, *SD* = 1.94) at follow-up. Condition 3 (Letter Sequencing) had a mean of 8.60 (range = 1-13, *SD* = 4.82) at baseline and a mean of 11.00 (range = 10-12, *SD* = 1.00) at follow-up. Condition 4 (Number-Letter Switching) had a mean of 8.40 (range = 1-13, *SD* = 4.93) at baseline and a mean of 8.80 (range = 3-12, *SD* = 3.78) at follow-up. Condition 5 (Motor Speed) had a mean of 8.80 (range = 6-11, *SD* = 2.16) at baseline and a mean of 10.60 (range = 9-13, *SD* = 1.67) at follow-up. No differences were found between assessment periods when exploring the DKEFS-TMT (Condition 1: T = 5.00, *Z* = -0.70, *p* = .480), (Condition 2: T = 1.50, *Z* = -0.81, *p* = .414), (Condition 3: T = 1.00, *Z* = -1.07, *p* = .285), (Condition 4: T= 1.50, *Z* = 0.00, *p* = 1.00), (Condition 5: T = 0.00, *Z* = -1.84, *p* = .066).

The HVLT-R yields scores for Total Recall, Delayed Recall, Retention Percentage, and Discrimination Ability. The total mean for Total Recall was 51.20 (range 40-60, *SD* = 9.83) at baseline, and 47.60 (range = 33-63, *SD* = 12.91) at follow-up. The total mean for Delayed Recall was 44.00 (range = 34-54, *SD* = 8.97) at baseline, and 45.20 (range = 21-63, *SD* = 19.62) at follow-up. The total mean for Retention Percentage was 37.20 (range = 20-55, *SD* = 13.21) at baseline, and 51.00 (range = 26-72, *SD* = 22.82) at follow-up. The total mean for Discrimination Ability was 64.80 (range = 51-105, *SD* = 22.70) at baseline, and 53.00 (range = 40-58, *SD* = 7.34) at follow-up. There were no differences found between any of the four total scores on the HVLT-R (Total Recall: T = 3.00, *Z* = -0.74, *p* = .461), (Delayed Recall: T = 7.00, *Z* = -0.14, *p* =

.843), (Retention Percentage: T = 3.00, $Z$ = -1.21, $p$ = .225), (Discrimination Ability: T = 7.00, $Z$ = -0.14, $p$ = .893) [see Tables 3 and 5].

**Baseline-Only Cases**

**Patient demographics.** Five [male, $n$ = 1 (20%); female, $n$ = 4 (80%)] of the ten participants were unable to schedule and return for a follow-up assessment. Of these five, four (80%) were diagnosed with Relapsing Remitting MS (RRMS), and 1 (20%) was diagnosed with Primary Progressive MS (PPMS). From this sample, ages ranged from 32-56 ($M$ = 41.40, $SD$ = 9.99). Three (60%) of the five participants identified themselves as white/European American and two (40%) of the participants identified themselves as African American. The BMI for this sample of participants ranged from 25.40 to 41.20 ($M$ = 31.62, $SD$ = 6.37), indicating that two (40%) of the individuals fell into an overweight range, and three (60%) were considered obese. The mean waist-to-hip ratio was .81 ($SD$ = .09, range = .72-.97). Three (60%) of the participants were categorized as healthy, and two (40%) were categorized as unhealthy according to the waist- to-hip ratio standard. An average of 6.90 was established for years since onset (range = 1-13, $SD$ = 5.21). Three (60%) of this group were taking Tysabri as their primary MS medication, one (20%) was taking Cellcept, and the other was taking Copaxone. Three (60%) were covered by insurance through their employer, and 1 (20%) was covered by SSDI. Other health problems were endorsed by three of the participants (high blood pressure, $n$ = 2; overweight, $n$ = 1). The other two participants did not report any other health issues [see Table 1].

**Treatment demographics.** Treatment, specific to MS, was recorded for all five follow-up participants. All participants had been under the care of a neurologist for varying periods of time (range = 1-13 years, $M$ = 6.70, $SD$ = 5.21). This sample reported seeing their neurologist at

an average of every 4.40 months, with a range of once every three months to once every six months (*SD* = 1.51). Four (60%) of the five participants reported receiving physical therapy. One participant received physical therapy for a period of one month, at a rate of once a week prior to the study. One participant received physical therapy for a period of four months, at a rate of twice a week prior to the study. The other participant had received physical therapy for six months at twice a week prior to the study. The fourth participant had received physical therapy for 36 months, described the treatment as "off and on," at a rate of once a week, and was currently in physical therapy during the time of the assessment. Three (60%) of the participants reported personal exercise (twice a week, *n* = 2; three times a week; *n* = 1). Each of the participants involved in personal exercise described different forms of physical activity (bicycling, *n* = 1; cardio, *n* = 1; walking and stretching, *n = 1*). One participant reported receiving occupational therapy for one month, at a rate of once a week. This same individual reported receiving vocational training, once a week for a period of one month [see table 2].

**Descriptive statistics of measures.** The following totals are representative of baseline means only. The FSS yielded a mean total of 46.60 (range = 30.00-63.00, *SD* = 15.59). For the PDQ the mean for functional disability was 27.60 (range = 0.00-55.00, *SD* = 21.20). The total mean for psychosocial items on the PDQ at baseline was 27.60 (range = 0.00-50.00, *SD* =. 12.21). Total scores for the PDQ were calculated at baseline (*M* = 39.80, range = 0.00-105.00, *SD* = 40.05). The total mean score for the Brief COPE (BC) was 2.65 (range = 2.21-2.96, *SD* = .27). For The State Trait Anxiety Inventory (STAI), the baseline mean score for state anxiety was 32.60 (range = 20.00-46.00, *SD* = 11.63). The baseline mean score for trait anxiety was 47.40 (range = 28.00-70.00, *SD* = 18.37). For the Multiple Sclerosis Impact Scale-29 (MSIS-

29), the mean score for physical impact was 48.00 (range = 29.00-68.00, *SD* = 13.87). The mean score for psychological impact at baseline assessment was 25.20 (range = 12.00-38.00, *SD* = 10.08). The Beck Depression Inventory-II (BDI-II) total mean score was 20.60 (range = 1.00-32.50, *SD* = 12.33). The Connor-Davidson Resiliency Scale-Revised (CDRS-R) total mean was 23.00 (range = 11.00-30.00, *SD* = 7.28). The total mean at follow-up was 27.60 (range = 27.00-30.00, *SD* = 1.34). For the Short Form-12 (SF 12), the mean for physical factors was 42.73 (range = 25.23-56.45, *SD* = 13.79). The mean for mental factors was 39.02 (range = 15.11-58.66.48, *SD* = 19.85). The total mean score for the International Physical Activity Questionnaire (IPAQ) was 27.90 (range = 10.60-58.20, *SD* = 22.60). The 6 Minute Walk Test (6MWT) had a mean distance of 1,262 feet (range = 1,170-1,365, *SD* = 83.11). The BORG (BORG) yielded four means for baseline assessment: Breathlessness before the 6MWT (Baseline: *M* = .40, range = 0.00-1.00, *SD* = .54); Fatigue before the 6MWT (Baseline: *M* = 1.70, range = 0.00-5.00, *SD* = 2.22); Breathlessness after the 6MWT (Baseline: *M* = 2.00, range = 0.00-4.00, *SD* = 1.41); and Fatigue after the 6MWT (Baseline: *M* = 2.40, range = 0.00-7.00, *SD* = 3.02). Means for the five different conditions were calculated for baseline assessment for the Delis-Kaplan Executive Function System, Trail Making Test (DKEFS-TMT). Condition 1 (Visual Scanning) had a mean of 8.00 (range = 4-10, *SD* = 2.34). Condition 2 (Number Sequencing) had a mean of 6.20 (range = 1-13, *SD* = 4.97). Condition 3 (Letter Sequencing) had a mean of 8.80 (range =7-12, *SD* = 1.92). Condition 4 (Number-Letter Switching) had a mean of 8.00 (range = 1-11, *SD* = 4.00). Condition 5 (Motor Speed) had a mean of 9.80 (range = 9-11, *SD* = .83). For the Hopkins Verbal Learning Test-Revised (HVLT-R), the total mean for Total Recall was 44.40 (range 32-59, *SD* = 10.80). The total mean for Delayed Recall was 45.80

(range = 20-61, *SD* = 15.28). The total mean for Retention Percentage was 50.80 (range = 26.00-62.00, *SD* = 15.15). The total mean for Discrimination Ability was 48.40 (range = 27.00-58.00, *SD* = 13.01) [see Table 4].

# CHAPTER FIVE

## Discussion

### Summary of Findings

Results of the present study did not provide evidence that the proposed battery was useful in monitoring treatment outcomes. Due to the lack of sufficient statistical power, there was only one indication of significant improvement or change in treatment outcomes from the initial assessment to the final assessment. There was a significant difference found between baseline and follow-up assessment when comparing breathlessness scores on the BORG. Individuals that returned for follow-up assessment indicated that they experienced less breathlessness before and after The Six Minute Walk Test at follow-up than during initial assessment. This could be due to weather changes and the way it affects individuals with MS. Individuals with MS tend to report improvement in symptoms when the weather changes from hot temperatures to more mild temperatures. Data collection for this present study began in the warmer months. Individuals returning for follow-up did so during the cooler months. However, this hypothesis is less likely considering breathlessness was the only symptom improvement. It is more likely that the significant difference found was a result of Type I error.

### Implications

The lack of significant results may be due to the relatively short (6 to 8 week) period between baseline and follow-up assessment. It may be more beneficial for providers to assess patients on a yearly basis versus every six weeks. However, the unpredictable nature of Multiple Sclerosis may make it necessary to assess MS patients on an individual basis. None of the participants in the present study were experiencing a MS exacerbation and there were no

significant changes in treatment outcomes from baseline assessment to follow-up. Lesions in the brain and diffuse damage to the CNS can pose many debilitating symptoms. It may be important for providers to consider a comprehensive assessment for patients during and after periods of exacerbation. It is important to note health differences between baseline-only participants and the participants that returned for follow-up assessment. Baseline-only participants had a higher mean BMI. All five baseline-only participants were considered overweight or obese and four out of the five participants reported experiencing other health problems. Health issues may be partially accountable for the reason behind individuals not returning for follow-up assessment. It may be important for future researchers and clinicians to consider other health issues (such as BMI) when developing a particular study or treatment plan, respectively. The small sample size for the study may have also been due to a lack in motivation to participate. The study did not offer any form of compensation to the participants.

**Limitations**

One of the limitations to the present study was the sample size. Only ten participants agreed to take part in the study. Recruitment rate was slow and many of the patients did not show up to their initial assessment. This could be due to a lack of motivation. The present study did not offer monetary compensation or treatment for participants. Another limitation of the study was the battery itself. Although the individual measures have demonstrated sensitivity and good psychometric properties in previous research, the full battery may not have been sensitive enough to identify changes in MS treatment outcomes using the present method. Lack of statistical power could also be due to the six-eight week period between baseline and final assessment. Changes or improvement in treatment outcomes may have been identified if the

period between assessments had been longer. Further research is needed to validate this battery as a useful tool in monitoring individualized treatment and treatment outcomes.

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Table 1

*Participant Demographics*

| Demographic Item | All Ten Participants | Follow-up | Baseline Only |
|---|---|---|---|
| Age (M, SD) | 42.70, 13.34 | 44.00, 17.21 | 41.40, 9.99 |
| Gender (n, %) | | | |
| Male | 2, 20% | 1, 20% | 1, 20% |
| Female | 8, 80% | 4, 80% | 4, 80% |
| Race/Ethnicity (n, %) | | | |
| African American | 3, 30% | 1, 20% | 2, 40% |
| White | 7, 70% | 4, 80% | 3, 60% |
| BMI (M, SD) | 27.41, 6.41 | 23.2, 2.76 | 31.62, 6.37 |
| Waist/Hip (M,SD) | .81, .08 | .81, .08 | .81, .09 |
| MS Type (n, %) | | | |
| RR | 8, 80% | 4, 80% | 4, 80% |
| PP | 1, 10% | 0, 0% | 1, 20% |
| SP | 1, 10% | 1, 20% | 0, 0% |
| PR | 0, 0% | 0, 0% | 0, 0% |
| Onset years (M,SD) | 8.05, 6.96 | 9.40, 8.79 | 6.90, 5.21 |
| Other Health Issues (n, %) | | | |
| Overweight | 1, 10% | 0, 0% | 1, 20% |
| High Blood Pressure | 4, 40% | 2, 40% | 2, 40% |
| Unspecified/None | 5, 50% | 0, 0% | 2, 40% |

| | | | |
|---|---|---|---|
| Primary MS Med. (n, %) | | | |
| Avonex | 2, 20% | 2, 40% | 0, 0% |
| Cellcept | 1, 10% | 0, 0% | 1, 20% |
| Copaxone | 1, 10% | 0, 0% | 1, 20% |
| Tysabri | 6, 0% | 3, 60% | 3, 60% |
| Type of Insurance (n, %) | | | |
| Through employer | 7, 70% | 4, 80% | 3, 60% |
| Medicare | 3, 30% | 1, 20% | 2, 40% |
| Vocational Status (n, %) | | | |
| Unemployed | 1, 10% | 0, 0% | 1, 20% |
| Full Time | 5, 50% | 2, 40% | 3, 60% |
| Part Time | 2, 20% | 2, 40% | 0, 0% |
| Retired | 2, 20% | 1, 20% | 1, 20% |
| Source of Income | | | |
| Own Employment | 7, 70% | 4, 80% | 3, 60% |
| Family Member | 1, 10% | 1, 20% | 0, 0% |
| SSI | 1, 10% | 0, 0% | 1, 20% |
| SSDI | 1, 10% | 0, 0% | 1, 20% |
| Yearly Income | | | |
| Under $24,999 | 1, 10% | 1, 20% | 0, 0% |
| $25,000-$34,999 | 1, 10% | 0, 0% | 1, 20% |

| | | | |
|---|---|---|---|
| $35,000-$49,999 | 2, 20% | 2, 40% | 3, 60% |
| $50,000-74,999 | 4, 40% | 1, 20% | 1, 20% |
| Over $75,000 | 2, 20% | 1, 20% | 0, 0% |
| Education (n, %) | | | |
| High School Grad | 1, 10% | 0, 0% | 1, 20% |
| Some College | 2, 20% | 1, 20% | 1, 20% |
| College Grad | 7, 70% | 4, 80% | 3, 60% |
| Religion (n, %) | | | |
| Protestant | 9, 90% | 5, 100% | 4, 80% |
| Other | 1, 10% | 0, 0% | 1, 20% |
| Residential Area (n, %) | | | |
| Urban | 1, 10% | 0, 0% | 1, 20% |
| Suburban | 8, 80% | 5, 100% | 3, 60% |
| Rural | 1, 10% | 0, 0% | 1, 20% |
| Relationship Status | | | |
| Married | 5, 50% | 1, 20% | 4, 80% |
| Never Married | 2, 20% | 2, 40% | 0, 0% |
| Divorced | 2, 20% | 1, 20% | 1, 20% |
| Co-habitating | 1, 10% | 1, 20% | 0, 0% |
| Children at Home | | | |
| 1 | 2, 20% | 1, 20% | 1, 20% |

| | | | |
|---|---|---|---|
| 2 | 1, 10% | 0, 0% | 1, 20% |
| None at home | 7, 70% | 4, 80% | 3, 60% |

Table 2

*Treatment Percentages*

| **Treatment Types (n, %)** | **All Ten Participants** | **Follow-up** | **Baseline Only** |
|---|---|---|---|
| Neurologist | 10, 100% | 5, 100% | 5, 100% |
| Physical Therapy | 4, 40% | 0, 0% | 4, 80% |
| Occupational Therapy | 1, 10% | 0, 0% | 1, 20% |
| Personal Exercise | 6, 60% | 3, 60% | 3, 60% |
| Individual Counseling | 1, 10% | 0, 0% | 1, 20% |
| Group Counseling | 0, 0% | 0, 0% | 0, 0% |
| Psych Assessment | 1, 10% | 0, 0% | 1, 20% |
| Vocational Assessment | 1, 10% | 0, 0% | 1, 20% |
| Vocational Training | 2, 20% | 1, 20% | 1, 20% |

Table 3

*Descriptive Statistics of Measures: Follow-Up Participants*

| Measure | Item Range | Range | Mean | SD |
|---|---|---|---|---|
| FSS | 1-7 | | | |
| T1 | | 30.00-49.00 | 38.60 | 7.50 |
| T2 | | 29.00-49.00 | 38.00 | 10.09 |
| PDQ | 0-10 | | | |
| Functional T1 | | 0.00-47.00 | 11.40 | 20.05 |
| T2 | | 0.00-41.00 | 11.20 | 17.16 |
| PsychoSocial T1 | | 0.00-27.00 | 6.80 | 11.47 |
| T2 | | 0.00-28.00 | 6.20 | 12.21 |
| Total T1 | | 0.00-74.00 | 18.20 | 31.49 |
| T2 | | 0.00-69.00 | 17.40 | 29.27 |
| BC | 1-4 | | | |
| T1 | | 2.29-2.86 | 2.47 | .23 |
| T2 | | 2.18-2.75 | 2.37 | .22 |
| STAI | 1-4 | | | |
| State T1 | | 21.00-49.00 | 34.80 | 13.19 |
| T2 | | 20.00-37.00 | 29.60 | 6.30 |
| Trait T1 | | 36.00-57.00 | 45.60 | 8.93 |
| T2 | | 32.00-57.00 | 42.40 | 9.98 |

| | | | | |
|---|---|---|---|---|
| MSIS-29 | 1-5 | | | |
| Physical | T1 | 25.00-81.00 | 38.00 | 24.08 |
| | T2 | 26.00-71.00 | 36.80 | 19.33 |
| Psychological | T1 | 13.00-28.00 | 21.40 | 6.26 |
| | T2 | 16.00-30.00 | 20.80 | 5.63 |
| BDI | 0-3 | | | |
| | T1 | 4.00-20.00 | 14.10 | 6.69 |
| | T2 | 7.00-19.50 | 12.70 | 4.59 |
| CDRS | 0-4 | | | |
| | T1 | 23.00-32.00 | 28.80 | 3.49 |
| | T2 | 27.00-30.00 | 27.60 | 1.34 |
| SF 12 | 1-5 | | | |
| Physical | T1 | 28.47-61.62 | 48.18 | 13.09 |
| | T2 | 30.09-58-48 | 47.25 | 10.41 |
| Mental | T1 | 21.90-53.44 | 41.68 | 12.73 |
| | T2 | 20.15-53.73 | 43.01 | 13.45 |
| IPAQ | | | | |
| | T1 | 11.55-128.40 | 52.27 | 53.53 |
| | T2 | 12.00-112.40 | 41.24 | 47.65 |
| 6MWT | | | | |
| | T1 | 533-1885 | 1335.60 | 512.29 |

| | | | | |
|---|---|---|---|---|
| | T2 | 660-2015 | 1384.20 | 483.48 |
| BORG | 0-10 | | | |
| Breath b walk | T1 | .00-.22 | .10 | .22 |
| | T2 | .00-1.00 | .50 | .50 |
| Fatigue b walk | T1 | .00-.50 | .30 | .27 |
| | T2 | .00-4.00 | 1.5 | 1.58 |
| Breath a walk | T1 | .50-2.00 | 1.50 | .70 |
| | T2 | .50-2.00 | 1.30 | .67 |
| Fatigue a walk | T1 | .50-2.00 | 1.30 | .67 |
| | T2 | .50-2.00 | 1.10 | .54 |
| DKEFS-TMT | | | | |
| Condition 1: | T1 | 3-14 | 8.60 | 4.82 |
| | T2 | 5-13 | 9.00 | 3.53 |
| Condition 2: | T1 | 6-13 | 9.80 | 3.11 |
| | T2 | 9-13 | 10.40 | 1.94 |
| Condition 3: | T1 | 1-13 | 8.60 | 4.82 |
| | T2 | 10-12 | 11.00 | 1.00 |
| Condition 4: | T1 | 1-13 | 8.40 | 4.93 |
| | T2 | 3-12 | 8.40 | 3.78 |
| Condition 5: | T1 | 6-11 | 8.80 | 2.16 |
| | T2 | 9-13 | 10.60 | 1.67 |

HVLT-R

| | | | | |
|---|---|---|---|---|
| Total Recall: | T1 | 40-60 | 51.20 | 9.83 |
| | T2 | 33-63 | 47.60 | 12.91 |
| DelayedRecall: | T1 | 34-54 | 44.00 | 8.97 |
| | T2 | 21-63 | 45.20 | 19.62 |
| Retention %: | T1 | 20-55 | 37.20 | 13.21 |
| | T2 | 26-72 | 51.00 | 22.82 |
| Discrimination: | T1 | 51-105 | 64.80 | 22.70 |
| | T2 | 40-58 | 53.00 | 7.34 |

*Note.* T1 refers to baseline assessment. T2 refers to follow-up assessment. For the full name of each assessment refer to Methodology Section.

Table 4

*Descriptive Statistics of Measures: Baseline Participants*

| Measure | Item Range | Range | Mean | SD |
|---|---|---|---|---|
| FSS | 1-7 | | | |
| T1 | | 30.00-63.00 | 46.60 | 15.59 |
| PDQ | 0-10 | | | |
| Functional T1 | | 0.00-55.00 | 27.60 | 21.33 |
| PsychoSocial T1 | | 0.00-50.00 | 27.60 | 21.20 |
| Total T1 | | 0.00-105.00 | 39.80 | 40.05 |
| BC | 1-4 | | | |
| T1 | | 2.21-2.96 | 2.65 | .27 |
| STAI | 1-4 | | | |
| State T1 | | 20.00-46.00 | 32.60 | 11.63 |
| Trait T1 | | 28.00-70.00 | 47.40 | 18.37 |
| MSIS-29 | 1-5 | | | |
| Physical T1 | | 29.00-68.00 | 48.00 | 13.87 |
| Psychological T1 | | 12.00-38.00 | 25.20 | 10.08 |
| BDI | 0-3 | | | |
| T1 | | 1.00-32.50 | 20.60 | 12.33 |
| CDRS | 0-4 | | | |
| T1 | | 11.00-30.00 | 23.00 | 7.28 |

| | | | | |
|---|---|---|---|---|
| SF 12 | 1-5 | | | |
| Physical T1 | | 25.23-56.45 | 42.73 | 13.79 |
| Mental T1 | | 15.11-58.66 | 39.02 | 19.85 |
| IPAQ | | | | |
| T1 | | 10.60-58.20 | 27.90 | 22.60 |
| 6MWT | | | | |
| T1 | | 1170-1365 | 1262 | 83.11 |
| BORG | 0-10 | | | |
| Breath b walk T1 | | .00-1.00 | .40 | .54 |
| Fatigue b walkT1 | | .00-5.00 | 1.70 | 2.22 |
| Breath a walk T1 | | .00-4.00 | 2.00 | 1.41 |
| Fatigue a walkT1 | | .00-7.00 | 2.40 | 3.02 |
| DKEFS-TMT | | | | |
| Condition 1: T1 | | 4-10 | 8.00 | 2.34 |
| Condition 2: T1 | | 1-13 | 6.20 | 4.97 |
| Condition 3: T1 | | 7-12 | 8.80 | 1.92 |
| Condition 4: T1 | | 1-11 | 8.00 | 4.00 |
| Condition 5: T1 | | 9-11 | 9.80 | .83 |
| HVLT-R | | | | |
| Total Recall: T1 | | 32-59 | 44.40 | 10.80 |
| DelayedRecall:T1 | | 20-61 | 45.80 | 15.28 |

| | | | |
|---|---|---|---|
| Retention %: T1 | 26-62 | 50.80 | 15.15 |
| Discrimination:T1 | 27-58 | 48.40 | 13.01 |

*Note.* T1 refers to baseline assessment.

Table 5

*Differences between baseline and follow-up Measures*

| Measure | Sum of Ranks (*T*) | Z | *p* | Effect Size (*r*) |
|---|---|---|---|---|
| BORG | | | | |
| Breathlessness | .00 | -2.00 | .046 | -0.89 |
| Fatigue | 6.50 | -0.27 | .786 | -0.12 |
| 6MWT | 3.00 | -1.21 | .225 | -0.54 |
| DKEFS-TMT | | | | |
| Condition 1 | 5.00 | -0.70 | .480 | -0.31 |
| Condition 2 | 1.50 | -0.81 | .414 | -0.36 |
| Condition 3 | 1.00 | -1.07 | .285 | -0.48 |
| Condition 4 | 1.50 | 0.00 | 1.00 | 0.00 |
| Condition 5 | 0.00 | -1.84 | .066 | -0.83 |
| HVLT-R | | | | |
| Total Recall | 3.00 | -0.74 | .461 | -0.33 |
| Delayed Recall | 7.00 | -0.14 | .843 | -0.06 |
| Retention | 3.00 | -1.21 | .225 | -0.54 |
| Discrimination | 7.00 | -0.14 | .893 | -0.06 |
| FSS | 3.00 | -0.74 | .461 | -0.33 |
| BDI-II | 5.00 | -0.67 | .500 | -0.30 |
| CDRS-R | 4.50 | -0.83 | .408 | -0.37 |
| MSIS-29 | | | | |
| Physical | 7.00 | -0.14 | .892 | -0.06 |

| | | | | |
|---|---|---|---|---|
| Psychological | 6.00 | -0.41 | .684 | -0.18 |
| SF-12 | | | | |
| Physical | 6.00 | -0.41 | .686 | -0.18 |
| Psychological | 5.00 | -0.67 | .500 | -0.30 |
| PDQ | | | | |
| Functional | 1.00 | -0.45 | .655 | -0.20 |
| Psychosocial | 1.00 | -0.45 | .655 | -0.20 |
| Total | 2.50 | -0.27 | .785 | -0.12 |
| STAI | | | | |
| State | 4.00 | -0.94 | .345 | -0.42 |
| Trait | 1.00 | -1.47 | .141 | -0.66 |
| IPAQ | 2.00 | -1.10 | .273 | -0.49 |
| BC | 2.00 | -1.48 | .138 | -0.66 |

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|---|---|---|---|
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2008 *State Anxiety between Introverted and Extraverted Individuals,* Presented at Psi Chi; Students of Psychology, March 2008