Evaluating the Effects of Cognitive-Behavioral Group Treatment for Chronic Pain Management in Individuals with Multiple Sclerosis

by

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A Thesis submitted to the Faculty of Graduate Studies of

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Abstract

The present studies focused on chronic pain conditions associated with multiple sclerosis (MS). The purpose of Study 1 was to provide a preliminary investigation into the feasibility of providing a 10-session group-based cognitive-behavioral treatment (CBT) for pain management for MS patients. Participants included eight individuals with MS-related chronic pain. After participating in the intervention, nonsignificant decreases across all three outcome measures (pain severity, interference in daily activities due to pain, and affective distress) were observed. The primary purpose of Study 2 was to provide a more detailed evaluation of the same CBT group program using a single-case research design. After completing a baseline assessment period, the 10-week CBT treatment was introduced, which was followed by a four-week post-treatment assessment phase. A secondary purpose of Study 2 was to gather information on social support received by this group of MS patients and to explore relationships between social support and the three outcome measures. Nine MS patients participated in this study. Results from Study 2 indicated that individuals taking part in this CBT group may have experienced some benefits following participation. However, most of these benefits appeared to be in the area of affective distress. Furthermore, the statistically and clinically significant decreases in distress which were observed did not tend to appear until during the post-treatment assessment phase of the study. Contrary to the hypotheses made, there did not appear to be statistically or clinically significant changes on the measure of pain severity. Also, the majority of participants reported statistically and clinically significant increases in interference due to pain during the treatment and post-treatment phases of this study. Although the results from the present research suggest that

CBT may have some benefits for MS patients who are experiencing chronic pain, it must be emphasized that MS is a complex neurological condition in which pain is just one of many difficulties faced by patients. Other MS symptoms including fatigue and mobility issues which were not addressed in this research may have accounted for the unexpected findings.

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Multiple sclerosis (MS) is a chronic neurological disease which causes the destruction of the myelin sheath around the axons of the central nervous system (CNS). This destruction results in sclerotic plaques or scar-like lesions, but generally leaves the nerve cells themselves intact (Brassington & Marsh, 1998; Mohr & Cox, 2001). These plaques block or distort the normal transmission of nerve impulses (Brassington & Marsh).

EPIDEMIOLOGY OF MS

MS affects approximately 55,000 to 75,000 people in Canada (Beck, Metz, Svenson, & Patten, 2005) and 350,000 people in the United States (Mohr & Cox, 2001). Current research has found that within Canada, the highest prevalence rates are observed in the Atlantic and Prairie provinces (Beck et al., 2005). Prevalence rates range from 180 cases per 100, 000 in Quebec to 350 per 100, 000 within the Atlantic provinces (Beck et al.). In the Prairie provinces, a prevalence rate of 340 cases per 100, 000 has been reported by Beck et al.

As in other autoimmune diseases, prevalence of MS among women is approximately twice that found in men (Brassington & Marsh, 1998; Mohr & Cox, 2001). MS is most often diagnosed in the prime of one's life. Although the median age of onset of symptoms related to MS has been reported to be 25 years (Beatty, 1996), there is often a delay before a definite diagnosis of MS is made. The average age at diagnosis is 30 years (Tremlett & Devonshire, 2006). Onset of MS after age 50 tends to be uncommon. Within a sample of 2,837 MS patients, Tremlett and Devonshire found that 5% had late-

onset MS (i.e., onset after age 50). MS has a very distinct ethnic and geographic distribution, with African and Asian populations having a very low incidence of MS and countries nearing the equator (such as South Africa) having a lower prevalence of MS (Brassington & Marsh; Compston & Coles; Hauser & Oksenberg, 2006).

DIAGNOSING MS

The 2005 International Panel on MS Diagnosis has provided an up-to-date set of diagnostic guidelines. These guidelines specify that a definite diagnosis of MS (in which there is no other explanation for the clinical presentation) can be made if there is the occurrence of two or more attacks (i.e., neurological symptoms) each lasting a minimum of 24 hours and objective testing [i.e., magnetic resonance imaging (MRI) or cerebrospinal fluid (CSF) analysis] which demonstrates the presence of two or more CNS lesions (Polman et al., 2005). If a patient initially presents with only one attack and/or one lesion, further MRI or CSF analyses are needed to warrant a diagnosis of MS or one must wait until a second clinical attack occurs which implicates a different lesion site (Polman et al.).

DISEASE COURSE AND PROGNOSIS

There are a number of possible courses that MS may take. A benign disease course, in which there is little disease activity and the individual remains fully functional 15 years after onset, characterizes approximately 10% to 15% of all MS patients (Lublin & Reingold, 1996; Mohr & Cox, 2001). It is estimated that between 75% and 80% of individuals with MS have a relapse-remitting course which is characterized by periodic disease exacerbations, or flare-ups (Compston & Coles, 2006; Mohr & Cox). Between 15% and 20% of individuals have a chronic progressive course (also referred to as a

primary progressive course) in which there is a steady worsening of symptoms with no exacerbations (Compston & Coles; Mohr & Cox). Although these three patterns represent the main courses that MS may take, several other disease courses have been identified. A secondary progressive course has been defined as one which initially appears as a relapse-remitting course but develops into a chronic progressive course (Mohr & Dick, 1998). A progressive relapsing course is one which is progressive in nature from the onset of the disease, but where there are also episodes of disease exacerbations (Mohr & Dick). Lastly, a malignant disease course occurs when there is a progressive course rapidly resulting in disability or death (Mohr & Dick). This last disease course is very rare.

Unfortunately, the course of MS can change at any time. Life expectancy following the onset of MS symptoms is generally estimated to be more than 30 years, yet this is variable and some individuals have only lived for a few months after onset whereas others have lived far beyond 30 years (Brassington & Marsh, 1998). What causes the cycles of relapses and remissions observed in MS, or what determines the progression of the disease remains unknown (Brassington & Marsh). However, recent research has found a relationship between stressful life events and exacerbations in the disease course of MS (Brown et al., 2006; Mohr, Hart, Julian, Cox, & Pelletier, 2004; Mohr & Pelletier, 2006). There is no cure for MS. However, current approaches to treatment focus on two areas: (a) treatment of the underlying disease (using medications such as interferon beta-1a, interferon beta-1b, and glatiramer acetate), and (b) treatment of the symptoms of the disease (Tselis & Lisak, 1999).

CLINICAL PRESENTATION OF MS

Symptoms and signs of MS are varied and tend to reflect both lesion site and lesion severity (Gaudino, Pollina, & Krupp, 1999). Ongoing symptoms can be classified into several general categories: (a) sensory disturbances, (b) motor disturbances, (c) visual problems, (d) fatigue, (e) cognitive disturbances, and (f) affective disturbances. Up to 90% of MS patients report experiencing various sensory dysfunctions (Lezak, 1995). Sensory symptoms in MS often include pain or numbness. Between 80 and 90% of MS patients report motor disturbances such as limb weakness, spasticity, or uncoordination (Lezak, 1995). Visual problems are reported by 65% of MS patients (Lezak). Common problems experienced are blurred vision, double vision, loss of color perception, and blindness in one or both eyes (Frohman, Frohman, Zee, McColl, Galetta, 2005). Debilitating fatigue is also typical in MS. Approximately 80% to 90% of individuals with MS experience fatigue (Brassington & Marsh, 1998; Rae-Grant, Eckert, Bartz, & Reed, 1999; Zifko, 2004). Of these, 40% report that fatigue is their most serious symptom (Brassington & Marsh). In some cases, fatigue can so severe that individuals are unable to be actively engaged in an activity for more than a few hours at a time. Cognitive and affective dysfunction are also significant problems for patients with MS. Point-prevalence estimates of cognitive dysfunction range from 40% to 60% (Brassington & Marsh, 1998; Mohr & Cox). Research has shown that 22% to 51% of MS patients show no evidence of cognitive impairment, whereas between 43% and 56% show mild to moderate impairment and 20% to 32% exhibit severe impairment (Gaudino et al., 1999). The cognitive impairments exhibited in individuals with MS are heterogeneous, varying greatly from person to person. However, there are a number of common areas in which

individuals with MS may experience difficulties. The majority of deficits are seen in the areas of speed of information processing, attention, executive functioning, and memory (Brassington & Marsh; Mohr & Cox, Satori & Edan, 2006). By far, the most common affective disturbance reported by MS patients is depression. Studies of clinical populations of MS patients have reported that there is a lifetime prevalence rate for depression of 50% (Mohr & Cox, 2001). Recent research of large Canadian community samples have reported prevalence rates of 16% and 17% in individuals with MS, as compared to a prevalence rate of 8% within a group of individuals without MS (Patten et al., 2005; Patten, Svenson, & Metz, 2005).

PAIN AS A COMMONLY REPORTED SYMPTOM IN MS

Pain has long been known to be a symptom of MS. As early as 1872, Charcot reported pain complaints in individuals suffering from MS. However, it has been only recently that research has begun to examine the pain experience in MS more extensively.

Prevalence of Pain in MS

Pain in MS is very common, with estimates of prevalence being highly variable (ranging from 13% to 80%; Archibald et al., 1994; Moulin, Foley, & Ebers, 1988). However, recent research estimates that at least 50% of individuals with MS experience some type of pain condition (Beiske, Pedersen, Czujko, & Myhr, 2004; Coyle, Santiago, Shank, Ma, & Boyd, 2000; Krupp & Rizvi, 2002; Moulin, 1998; Stenager, Knudsen, & Jensen, 1991; Rae-Grant, Eckert, Bartz, & Reed, 1999). Pain can present as a symptom at onset of MS or can occur at any other point during the course of MS. Indaco, Iachetta, Nappi, Socci, and Carrieri (1994) reported that 21% of their sample of individuals with MS indicated that pain was a symptom at the onset of their disease while 70% indicated

that they had experienced pain at some point during the course of the disease. This is consistent with previous research (e.g., Stenager et al., 1991). Although reports suggest that up to 30% of patients with MS report pain to be one of the most severe symptoms of the disease (e.g., Archibald et al., 1994; Howarth, 2000), current research suggests that MS patients may experience a moderate level of pain severity. Ehde et al. (2003) reported that in a community sample of 442 individuals with MS, 44% reported persistent pain in the three months prior to study and that the average pain severity rating was 5.2 on a 11-point numerical rating scale, indicating a moderate level of pain. This is consistent with research conducted by Beiske et al. (2004) which found that 44% of their MS sample reported experiencing moderate levels of pain intensity.

Pain is consistently reported among all MS disease subtypes. Archibald et al. (1994) found that in their sample of MS patients 47% of individuals with a relapse-remitting course 54% of individuals with relapse-progressive, and 52% of individuals with chronic progressive reported some type of pain in the past month. A previous study conducted by Warnell in 1991 also found no significant difference in reports of pain among MS disease subtypes.

It is currently unclear if reports of pain are related to variables such as age, gender, disease severity, disability, or disease duration. Several studies have reported that pain reports increase as time since diagnosis increases (e.g., Clifford & Trotter, 1984; Howarth, 2000; Moulin et al., 1988; Stenager et al., 1991). However, other research has failed to find such a relationship (e.g., Archibald et al., 1994; Beiske et al., 2004; Indaco et al., 1994; Kalia & O'Connor, 2005; Osterberg et al., 2005; Rae-Grant et al., 1999). In several studies, prevalence of pain and pain severity do not appear to be related to degree

of disability (Archibald et al., 1994; Beiske et al.; Indaco et al. 1994, Moulin et al., 1988; Osterberg et al.; Rae-Grant et al., 1999; Vermote, Ketelaer, & Carton, 1985). However, Archibald et al. did find that one's degree of disability was significantly correlated with the number of hours per week one reported to have experienced pain ($r = 0.32, p < 0.05$). Similarly, Ehde et al. (2003) found that compared to individuals without pain, those experiencing persistent pain tended to suffer from more severe MS.

There have also been inconsistent findings reported in regard to gender and age differences in pain reports. Some studies have found that females with MS were more likely to report pain than males (e.g., Clifford & Trotter; Moulin et al.; Warnell, 1991). In addition, Moulin et al. found that reports of pain were significantly correlated with age, with older individuals reporting more pain. Studies conducted by Clifford and Trotter as well as by Warnell report similar results. However, these age and gender differences have not been found in more recent MS research (e.g., Archibald et al.; Beiske et al.; Indaco et al.; Kalia & O'Connor; Osterberg et al.; Stenager et al.).

Etiology of Pain in MS

There appear to be two general pain conditions in MS. These conditions are neuropathic pain and nociceptive pain. Nociceptive pain (or somatic pain) refers to pain which is "an appropriate physiological response experienced when nociceptor sensory units in bone, muscles, and any body tissue are activated to transmit afferent impulses at the conscious level" (Solaro, Lunardi, & Mancardi, 2003, p. 15). One the most common examples of nociceptive pain in MS is back pain which often results from poor posture, mobility issues, and muscle weakness (Clanet & Brassat, 2000; Malino, 2000; Solaro et al., 2003).

In contrast, neuropathic pain is a result of lesions (or injury in general) in the nervous system, either peripherally or centrally (Fausett, 2002). MS is a common cause of neuropathic pain, however the specific mechanisms through which MS causes this type of pain are not well understood. Solaro et al. (2003) propose that several complex mechanisms are likely involved. Lesions and demyelination of axons along the spinothalamic and quintothalamic sensory pathways in the nervous system may result in changes in ion channels which can lead to signals which are experienced by individuals as pain (Osterberg, Boivie, & Thuomas, 2005; Solaro et al.). It has also been proposed that neuropathic pain may result from the sensitization of medullary neurons which causes abnormal neuronal firing or that an imbalance of inhibitory and excitatory mechanisms at various levels within the sensory pathways may be to blame (Fausett; Osterberg et al., 2005; Solaro et al.). Research continues to try to further delineate the mechanisms responsible for this type of pain condition.

Acute, Subacute, and Chronic Pain Syndromes in MS

Moulin (1998) classified pain syndromes in MS as being acute, subacute, or chronic. This classification appears widely in the MS literature and will therefore be described further here.

Acute MS pain tends to be brief and of a sudden onset (Maloni, 2000). Indaco et al. (1994) defined acute pain as "a transient symptom of short duration, that is lasting less than one month" (p. 98). Using this definition, 28% of a sample of individuals with MS was found to suffer from acute pain (Indaco et al.). A more recent study conducted by Beiske et al. (2004) found that 38% of their sample of MS patients reported acute pain. Common acute pain complaints in MS include neuralgic pain of the face or head,

Lhermitte's symptom, pain associated with tonic seizures, and migraine, cluster, or tension headaches (Indaco et al.; Krupp & Rizvi, 2002; Maloni; Moulin, 1998; Moulin et al., 1988).

Neuralgia of the face or head (known as trigeminal neuralgia) occurs in 1% - 2% of MS patients (Clanet & Brassat, 2000; Indaco et al., 1994; Krupp & Rizvi, 2002; Maloni; Moulin et al., 1988). This type of pain is experienced as sharp, shock-like attacks lasting from between several seconds to several minutes (Maloni; Moulin, 1998). Any facial movement (e.g., chewing or smiling) may trigger this pain (Maloni).

Tonic seizures are unilateral muscle twitching, cramping, and spasms which are typically accompanied by severe pain (Maloni, 2000). Most often these seizures occur in the limbs (Maloni). Pain associated with tonic seizures has been estimated to occur in 2% of individuals with MS (Indaco et al., 1994; Moulin et al., 1988). Burning, aching, or itching acute limb pain not associated with tonic seizures is also reported by individuals with MS (Maloni).

Lastly, painful Lhermitte's symptom occurs in approximately 5% of individuals with MS (Indaco et al., 1994; Moulin et al., 1988). Lhermitte's symptom consists of an electrical sensation that passes down the back to the legs on neck flexion (Indaco et al., 1994; Moulin et al., 1988).

Subacute pain syndromes have been identified in the literature as resulting from either an increase in MS symptoms or the medications used to treat MS, typically lasting for a relatively short period of time before resolving (Malino, 2000; Moulin, 1998). For instance, pain associated with optic neuritis has been found to occur in 9% of MS patients

(Indaco et al., 1994; Moulin et al., 1988). Muscle aches and headaches resulting from MS medications are also common complaints (Malino).

Indaco et al. (1994) found that 72% of individuals with MS reported suffering from chronic pain, defined as "constant or intermittent pain lasting more than one month" (p. 98). In contrast, Beiske et al. (2004) found that a lower percentage of MS patients reported pain of longer than one month duration (51% of patients). One of the most common types of chronic pain experienced in MS is neuropathic (either central or peripheral) pain, particularly in the lower extremities (Benrud-Larson & Wegener, 2000). The pain is usually worse at night, after exercise, or when there are changes in temperature or weather (Malino, 2000). Such pain is described by a range of descriptors including burning, aching or throbbing, electrical, numbness, shooting, squeezing, broken glass, cutting, cold, and pins and needles (Beiske et al.; Fausett, 2002; Osterberg et al., 2005; Solaro et al., 2003). Prevalence rates of neuropathic pain range from 25% to 33% (Benrud-Larson & Wegener; Indaco et al.; Kalia & O'Connor, 2003; Moulin, 1998; Osterberg et al.). Within this general classification of neuropathic pain, a recent study conducted by Kalia and O'Connor found that 71% of individuals with MS pain reported experiencing neuropathic pain which was characterized by burning pain in the extremities whereas 29% of individuals reported pain characterized by pins and needles and numbness. One of the first research studies to examine the prevalence of central neuropathic pain reported that 28% of MS pain may be a result of CNS mechanisms.

Chronic low back pain is also common in MS, estimated to occur in 20% - 22% of MS-related pain cases (Beiske et al., 2004; Indaco et al., 1994; Osterberg et al., 2005; Solaro et al., 2003). Chronic leg spasms also result in pain for MS patients and although

early research (e.g., Indaco et al., 1994; Moulin, 1998) reported that spasms may be one of the most frequently reported types of chronic pain in MS, more recent research conducted by Osterberg et al. found that spasms were infrequently reported. Leg spasms are typically described as cramping, pulling pain and tend to occur more frequently at night and during periods of disease relapse.

Impact of Pain on Individuals with MS

Few studies have examined the impact of pain on individuals with MS and results from these studies have varied. However, for the most part, research has reported that pain typically has an adverse impact on areas such as mental health, general physical health, work performance, and social relationships for an individual with MS. For instance, Archibald et al. (1994) found that individuals with MS who report pain report significantly poorer mental health (i.e., anxiety, depression, loss of behavioral and emotional control, general negative affect, loss of emotional ties). Similarly, Kalia and O'Connor (2005) and Ehde et al. (2003) also reported that individuals with MS-related pain tend to also experience high levels of anxiety and depression. On the other hand, Stenager et al. (1991) did not find any significant differences between MS patients with and without pain in terms of reported depressive symptoms. With respect to work performance, Archibald et al. reported that MS patients felt that their ability to perform at work had been negatively affected by their pain more so than a group of individuals without pain. Warnell (1991) also reported that 49% of their sample of MS patients reported that pain interfered in their ability to work. Furthermore, Warnell found that 49% of their sample of individuals with MS reported that their pain interfered with sleep and 34% reported interference in relationships with family and friends. More recently,

Beiske et al. (2004) also found that those MS patients with more severe pain symptoms also reported more difficulties with fatigue and indicated that they were less able to perform activities of daily living at home and work.

Recent research examining the association between interference due to pain in MS and various demographic and disease-related variables has found that greater pain interference is significantly related to increased fatigue, poorer general health, decreased perceived social support, and increased depressive symptom severity (Osborne et al., 2006). However, these results should be viewed with caution as the generalizability of the findings may be limited by the nature of the sample studied (war veterans with MS of whom most were male).

Managing Pain in MS

Current pain management in MS consists primarily of pharmacologic treatments. Archibald et al. (1994) found that 64% of the individuals they surveyed had taken some type of medication for their pain during the prior month and that 90% of these individuals rated the medication as being 50% effective or greater. Two more recent studies however have found that a substantial lower number of individuals report using medication to manage pain. In their survey, Rae-Grant et al. (1999) found that only 31% of individuals were taking medication at the time of the survey. The medications most commonly used by this sample of individuals with MS were over-the-counter medications, although the specific types of medications being used was not reported in this study (Rae-Grant et al.). Similarly, Kalia and O'Connor (2005) found that only 26% of their study had received treatment for their pain in the previous month. The medications most commonly used by this sample of individuals were anti-inflammatories (69% of individuals used this

treatment), general analgesics (42% using), opiate analgesics (12% using), anti-epileptics (15% using), antidepressants (12% using), and muscle relaxants (19%).

More recently, Heckman-Stone and Stone (2001) reported on the effectiveness of a wider range of pain management techniques in a sample of 83 MS participants. Rated as being most effective in managing pain were medication (45% of sample rating this to be most effective), physical manipulation such as changing positions, massage, or pressure (21%), exercise (13%), psychosocial or alternative techniques (12%), and rest or sleep (9%). Conversely, pain management techniques rated as being least effective were medication (48%), psychosocial or alternative techniques (24%), physical manipulation (15%), exercise (8%), and rest or sleep (5%). It would appear from this survey that most pain management techniques which MS patients find to be helpful in managing pain can also be ineffective at times. This might suggest that a type of therapy which is helpful for one person may not be as effective for the next person. Heckman-Stone and Stone indicated that it was unclear whether all participants had access to and awareness of all the types of nonpharmacologic treatments available. They also emphasize that since it would appear from this research that individuals with MS are using some nonpharmacologic treatments for pain relatively frequently and report some benefit as a result, further research should be conducted on variables such as the nature and effectiveness of such techniques.

Viewing pain from a unidimensional medical model has proved insufficient in explaining the variability among people's reactions to pain disorders and their inconsistent responsiveness to conventional forms of treatment (Turk, Rudy, & Flor, 1985). It is now accepted that there is a range of psychosocioeconomic factors (e.g.,

gender, socioeconomic status) that interact with an individual's physical pain experience to influence the individual's self-report of pain, their disability due to pain, and their response to treatment. Therefore, leaders in pain management research now suggest that a more comprehensive, multidisciplinary approach to the study of pain and its management is needed (Asmundson, Hadjistavropoulos, & Antonishyn, 2001).

However, there appears to be very few published reports concerning the nature or effectiveness of psychological interventions to manage pain in MS. A recent literature review found three case study research papers that reported short-term pain relief following hypnosis in individuals with MS (Dane, 1996; Medd, 1992; Sutcher, 1997). One other published study examined the feasibility of providing a group-based cognitive restructuring intervention for chronic pain in a group of individuals with various disabilities such as amputations (n = 4), spinal cord injury (n = 10), cerebral palsy (n = 2), and MS (n = 2; Ehde & Jensen, 2004). This study compared the effects of eight, 90-minute group cognitive restructuring sessions to an eight-session group educational control intervention. When comparing ratings of pain intensity prior to and after participating in group sessions, those in the educational control group showed no difference in pain intensity while those in the cognitive restructuring intervention reported an average of 0.5 standard deviation (SD = 2.0) decrease in pain intensity. Although this study is limited due to a high attrition rate (33%), a small sample size (n = 18), and a nonrandomized design, its results do suggest that there is potential benefit for a group-based cognitive intervention for a disability-related chronic pain condition such as MS.

Although it appears that there has been no further research published on the use of other psychological interventions for pain management in individuals with MS, a number of pain management strategies have proven successful with other types of chronic pain conditions and may be of use in managing MS-related pain.

Psychological Interventions for Chronic Pain

The most widely used psychological interventions for chronic pain management include relaxation training, biofeedback, operant conditioning, hypnosis, and cognitive-behavioral therapy (CBT). The present studies included one of these interventions, CBT. Therefore, this strategy will now be outlined in more detail.

Over the last two decades, the utilization of CBT for pain management has grown considerably. Four goals of CBT for chronic pain management have been identified: (a) to help individuals with chronic pain believe that they can manage their pain, (b) to help individuals with chronic pain learn to identify and monitor their thoughts, feelings, and behaviors and understand how these three things are interrelated, (c) to help individuals with chronic pain engage in appropriate behaviors in order to cope better with their pain, and (d) to help individuals with chronic pain continue to use adaptive coping strategies even after treatment has ended (Holzman, Turk, & Kerns, 1986).

Common Components in Cognitive-Behavioral Therapy for Pain Management and Delivery of Programs

Although CBT interventions may vary depending on the specific chronic pain condition, there are a number of key components to CBT for chronic pain. These components typically include reconceptualization of pain through education, goal setting,

training in pain-coping strategies (e.g., relaxation training, distraction, and pacing), and training in cognitive restructuring techniques.

In the education component of CBT, individuals are generally provided with information about CBT and their chronic pain condition. The main goals of this phase are to facilitate hope and active participation in coping and provide a rationale for treatment to facilitate adherence (Bradley, 1996). Once chronic pain patients achieve a basic understanding of their pain and the treatment program, the second phase of treatment is initiated: skill acquisition. During this phase, individuals are introduced to a number of strategies that they can use to cope with their pain. Training in relaxation techniques such as progressive muscle relaxation, imagery relaxation, and diaphragmatic breathing can be incorporated into treatment. Individuals may also be trained in attention diversion strategies such as deliberately diverting one's attention to an object in one's surroundings, counting in one's head, or imagining a pleasant scene (Bradley). Teaching individuals to pace their activities is also an effective pain-coping strategy. Cognitive restructuring techniques are also employed in treatment. Cognitive restructuring encourages individuals to identify and challenge maladaptive or unrealistic thinking patterns relating to their pain experience. The last component of CBT that is typically included in treatment programs involves ensuring that the pain-coping skills that have been acquired by individuals are maintained once treatment is completed. One part of this is to have individuals try to anticipate future problems that may arise relating to their pain and develop a plan for dealing with these problems before they result in a complete return of pain or relapse (Bradley).

CBT can be successfully administered in either individual sessions or in a group format (e.g., Johnson & Thorn, 1989). Although individual treatment has the advantage of being easily tailored to the specific individual, there are many advantages of group CBT for chronic pain. First, a group format allows those with chronic pain to meet others who are dealing with similar conditions, thereby normalizing their problems. Secondly, group members can also provide each other with advice or support about how to handle certain situations. Morley, Eccleston, and Williams (1999) reported that in a review of recent CBT research in pain, 76% of treatments were delivered in a group format.

CBT tends to be a time-limited treatment, typically lasting between six and 12 weeks (Keefe, Beaupre, & Gil, 1996). A meta-analysis of CBT studies in chronic pain found that the duration of treatments averaged 6.7 weeks, with a median of 16 hours of treatment (Morley et al., 1999). In a reviewing of CBT research, each session may run anywhere from one and three hours.

CBT has been extensively studied in terms of its efficacy for managing pain. Numerous studies have reported long-term (i.e., follow-up assessments of up to four years) benefits following individual and group formats of CBT for individuals suffering from chronic back pain (e.g., Nicholas, Wilson, & Goyen, 1991), headaches (e.g., Johnson & Thorn, 1989), arthritis (e.g., Sharpe et al., 2001; Sinclair, Wallston, Dwyer, Blackburn, & Fuchs, 1998), and fibromyalgia (Creamer, Singh, Hochberg, & Berman, 2000). A recent meta-analysis conducted by Morley et al. (1999) examined 25 randomized controlled trials of CBT for chronic pain and found that CBT is more effective than wait-list controls in decreasing reports of pain, decreasing physical as well as psychological disability, and increasing the use of positive cognitive coping strategies

(with effect sizes ranging from 0.36 to 0.60). This meta-analysis examined chronic pain conditions including chronic low back pain, pain related to rheumatoid arthritis and osteoarthritis, mixed back pain, fibromyalgia, upper limb pain, and unspecified pain. In 1995, CBT was listed as an empirically validated or supported psychological treatment for chronic pain (Tan & Leucht, 1997).

Although the previously-mentioned study by Ehde and Jensen (2004) appears to be the only published research on the use of cognitive and/or CBT for pain management which included participants with MS, much research has been conducted using chronic back pain patients and pain related to other types of autoimmune disorders. A summary of group CBT programs for these pain conditions is provided. It should be noted however that although there are some common key components to CBT for pain management (as noted previously), as one reviews the research literature it becomes apparent that the definition of what constitutes cognitive-behavioral treatment is not uniform and this variability in treatment programs can create difficulties in making comparisons among studies.

Cognitive-Behavioral Group Therapy for Chronic Back Pain

Chronic back pain is commonly reported by individuals with MS. It is also one of the most prevalent types of pain in individuals without MS, with over 80% of individuals reporting experiencing back pain at some point in their lives (Cassidy, Carroll, & Cote, 1998). Due to its high prevalence, there has been a great deal of research done on using CBT to help cope with chronic back pain. Tables 1 and 2 summarize some of the research on group CBT that has been conducted in this area.

Cognitive-behavioral group therapy versus no-treatment control conditions.

Research has consistently found that when compared to no-treatment control conditions, those pain patients participating in CBT group programs report significantly less pain severity, affective distress, and disability following the intervention and for up to six months post-treatment (Kerns, Turk, Holzman, & Rudy, 1986; Newton-John, Spence, & Schotte, 1995; Turner, 1982; Turner & Clancy, 1988; Vlaeyen, Haazen, Schuerman, Kole-Snijders, & van Eek, 1995). These benefits are reported despite differences in sample characteristics, treatment durations (CBT programs ranged from 7.5 hours to 16 hours) and differences in treatment components. (See Table 1 for a summary of these studies.)

Cognitive-behavioral group therapy versus non-psychological interventions.

A recent review of the literature found only three studies which have compared group-based CBT interventions with non-psychological interventions (such as typical medical interventions or physiotherapy). Unfortunately, results from this research have been conflicting (see Table 2). Contrary to Altmaier, Lehmann, Russell, Weinstein, and Feng Kao (1992)'s results, Nicholas, Wilson, and Goyen (1992) and Basler, Jakle, and Kroner-Herwig (1997) found that adding a psychological component to physiotherapy resulted in significantly more improvements in participants' functioning. Furthermore, Basler et al. (1997) also report that following CBT participants showed significant reductions in pain severity as compared to those receiving typical medical management, while Altmaier et al. (1992) did not find such improvements in pain severity.

When interpreting these conflicting findings one should be cautious due to several reasons. First, the three studies used different measures of disability or ability to function in daily activities. For instance, although adding a psychological component to physical

therapy may not result in differences in one's ability to return to work or one's physical performance of activities, a psychological component to treatment may be most beneficial in increasing one's ability to perform in one's social role. CBT treatment components also differed across studies. Whereas Altmaier et al.'s program consisted of training in relaxation, biofeedback, and the use of adaptive coping strategies, Nicholas et al.'s 1992 study also included education, goal setting, and cognitive restructuring. Basler et al.'s 1997 study, however, consisted of education, relaxation training, cognitive restructuring, activity scheduling, as well as typical medical treatments. Lastly, treatments varied with respect to duration. Altmaier et al.'s CBT program consisted of 17.5 hours of treatment, whereas Basler et al.'s study included 30 hours of CBT. This difference in treatment dose may have accounted for the decreases in pain severity Basler et al. reported. The application of the psychological program used in Altmaier et al.'s study is unclear from the description provided in the published paper. Unfortunately, there are no details provided in regards to the duration of each treatment session, or how often sessions were run. For these reasons, it may not be reasonable to compare the results of these three studies.

Cognitive-behavioral group therapy versus other psychological interventions.

There are many other group-based psychological interventions for chronic back pain, including operant-behavioral interventions, as well as training in biofeedback or relaxation strategies such as progressive muscle relaxation. Over the past 20 years, the literature has reported that both CBT and operant-behavioral interventions provide benefits for chronic pain patients, including those with chronic back pain. In addition, the research seems to indicate that although behavioral interventions yield more immediate

benefits, in the long-term, CBT interventions are as effective, if not more effective, than behavioral treatments. Benefits appear to be in the areas such as pain severity, affective distress, disability, medication use, pain-related beliefs, and pain behaviors.

Although the four studies presented in Table 1 which compare the effectiveness of behavioral treatments and CBT suggest that CBT results in as many long-term benefits for pain management as behavioral interventions, generalization across studies is difficult due to differing methodologies and samples (Kerns et al., 1986; Nicholas, Wilson, & Goyen, 1991; Turner & Clancy, 1988; Vlaeyen et al., 1995). All of this research involved chronic back pain patients, however, Kerns et al. included individuals with other types of pain complaints. In addition, participants in these studies received any where from 10 to 18 hours of treatment. Lastly, outcome measures varied among studies. All four studies employed a measure of physical disability or interference, pain severity, and pain cognitions were measured in three of the studies. However, many other outcomes were measured in these studies (e.g., health care service usage, dependence on others, affective distress, and pain behaviors).

Similar to the results of research comparing CBT and behavioral treatments, research has not found significant differences between interventions consisting of only relaxation training when compared to CBT programs, in the short-term. However, in the long-term it does appear that CBT may result in more benefits than relaxation (see Table 1). Although Turner (1982) found that there were no differences between these two group interventions at post-treatment on measures of disability, depression, and pain severity, at a one-month follow-up, only the CBT group exhibited further improvements on the three outcome measures. Similarly, Turner and Jensen (1993) found that there were no

significant differences between individuals participating in a relaxation only intervention, a cognitive intervention only, and a combined relaxation/cognitive intervention on measures of depression, disability, and pain severity. Improvements within all of these groups were maintained at six and 12 month follow-ups. The results of this study by Turner and Jensen should be viewed with caution however as all participants were only experiencing mild symptoms on all measures at pre-treatment.

Conflicting results have been reported when comparing the efficacy of CBT and biofeedback (see Table 1). Both studies presented in Table 1 did not find significant differences between these two group interventions on measures of pain severity at post-treatment (Flor & Birbaumer, 1993; Newton-John et al., 1995). Furthermore, no immediate differences were found on measures of catastrophizing, interference, affective distress, and on the use of pain coping strategies. However, at a six-month follow-up, Flor and Birbaumer report significant improvements for those individuals in the biofeedback group (as compared to those receiving CBT) on measures of pain severity, interference, and distress. Newton-John et al. did not find any group differences at follow-up. However, there are some features of Flor and Birbaumer's study that warrant criticism. First, this study used a heterogenous sample of chronic back pain patients, as well as individuals with tempomandibular pain, whereas Newton-John et al.'s (1995) study included only those experiencing chronic back pain. In addition, the CBT intervention was relatively short in duration (eight hours compared to 16 hours of treatment received in the study by Newton-John et al.). These differences may limit generalizability across these two studies.

Cognitive-Behavioral Group Therapy for Pain Related to Autoimmune Diseases

In addition to MS, there are many autoimmune diseases such as lupus, chronic fatigue syndrome, and rheumatoid arthritis. Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by symptoms of joint pain, stiffness, and fatigue (Kraaimaat, Brons, Geenen, & Bijlsma, 1995). Since RA resembles MS in several aspects (e.g., resulting in physical limitations, psychological distress, and pain) and there is research that has been conducted using CBT with RA, this next section will discuss how effective group CBT has been for RA patients.

Several studies have examined the use of CBT for RA-related pain management (see Table 3). Taken together, these studies indicate that CBT may be more effective than control conditions in reducing joint impairment or swelling and in increasing RA knowledge and feelings of self-efficacy relating to one's pain, at least in the short-term (Kraaimaat et al., 1995; O'Leary, Shoor, Lorig, & Holman, 1988; Radojevic, Nicassio, & Weisman, 1992; Sinclair & Wallston, 2001). There have been varying reports on the benefits of CBT on measures of pain severity, with several studies reporting such benefits (e.g., Appelbaum, Blanchard, Hickling, & Alfonso, 1988; O'Leary et al., 1988) but others not finding significant decreases following treatment (e.g., Kraaimaat et al.; Radojevic et al., 1992). Although one study found that following participation in a CBT program patients reported a decrease in difficulty completing functional tasks (Appelbaum et al., 1988), others have not found similar results. Similarly, only one study found statistically significant improvements in psychological wellbeing (e.g., decreased negative affect and increased positive affect) following treatment, however a limitation of this research was that it did not include a control or comparison group (Sinclair & Wallston).

As in much of the research using CBT, these studies vary greatly in many aspects. Sample sizes varied widely, several studies included only women participants, treatment duration ranged from six to 20 hours, outcome measures varied, and CBT programs varied with respect to topics covered. Therefore, it is difficult to make clear comparisons across the studies.

In sum, despite the wide use of CBT in pain management, a review of the literature has found only one published study examining the use of a cognitive restructuring intervention for disability-related chronic pain (including those suffering from MS). However, previous chronic pain research has indicated that for those individuals suffering from chronic back pain and pain related to rheumatoid arthritis, CBT may result improvements when compared to control groups (especially for individuals suffering from chronic back pain). The present studies attempted to extend this research by examining the use of psychological group-based intervention for MS-related chronic pain.

STUDY 1: FEASIBILITY OF PSYCHOLOGICAL GROUP INTERVENTION FOR MS-RELATED CHRONIC PAIN

Purpose of Present Study and Hypotheses

Initially, the primary purpose of this study was to provide a controlled experimental evaluation of the effectiveness of a CBT intervention for pain management for MS-related pain as compared to two control conditions: (a) a support/social interaction control group (SS), and (b) a wait-list control group (WL). However, in clinical research, a number of limitations and practical issues can arise with the use of group comparison designs. The present study was not immune to such issues. In

particular, this study came across difficulties recruiting sufficient numbers of participants in order to obtain a moderate level of power to detect differences between groups on outcome measures. An initial power analysis indicated that a sample size of 20 per condition would detect a significant effect, at an alpha level of 0.05 and a power of 0.80, therefore a total sample size of 60 was initially targeted. Unfortunately, this target of 60 participants was not reached and the primary investigator, along with the agreement of the advisory committee for this research, decided to offer participants the opportunity to take part in the CBT group program as a means of collecting preliminary data on the feasibility and usefulness of such an intervention.

Previous research has indicated that for those individuals suffering from chronic back pain, CBT results in significant decreases in severity of pain, disability or interference due to pain, and psychological distress when compared to attention control and wait-list control groups. Although the research on the effectiveness of CBT for those suffering from pain related to RA (an autoimmune disease similar to MS in many aspects) is not as conclusive as to the benefits of treatment on measures of pain severity, disability, and distress, because individuals suffering from MS-related pain often experience high levels of back pain in addition to chronic pain which is neuropathic in nature, hypotheses for the present pilot study considered possible treatment effects for both types of MS-related pain conditions. Therefore, it was presently hypothesized that individuals taking part in the CBT treatment group would report significantly less severe pain, less pain-related physical disability, and less psychological distress at post-treatment and at three-month follow-up as compared to pre-treatment reports.

Method

Study Design

Ethical approval for this study was received from the University of Manitoba, as well as the Health Sciences Centre in Winnipeg, MB, and the University of Calgary/Calgary Health Region prior to its start. Although the initial proposed design of the study was a pretest/posttest control group comparison with three-month follow-up, due to recruitment difficulties this study became an uncontrolled pilot study.

Setting and Participant Recruitment

Potential participants were identified by the clinical nurse specialists within the MS Clinic at the University of Calgary in Calgary, AB or by the primary researcher via chart review. The criteria for referral of potential participants was: (a) definite diagnosis of MS made by a neurologist, (b) at least 18 years of age, (c) pain of at least one month duration, (d) able to speak and read English, (e) not currently participating in other educational or supportive interventions for their pain problem, and (f) cognitive functioning intact or mild impairment, as determined by the clinical nurse specialist and/or previous neuropsychological testing.

The primary researcher then met briefly with each of the eligible participants identified to describe the study in more detail and obtain informed consent if the individual agreed to participate (see Appendix A for a complete copy of the project description and consent form). Participants were given an honorarium of $25 to assist in costs relating to transportation to and from sessions.

Participants

The participants in this pilot study included eight adults with a diagnosis of MS. The sample consisted of three women (38%) and five men (62%) with a mean age of 47

years (*SD* = 8, range = 37 to 61 years). All of the participants were caucasian. The majority (88%) were married; one individual was divorced. Within the sample, the mean number of years of education completed was 15 (*SD* = 2.5, range = 12 to 19 years). The majority (88%) of individuals were not working outside of the home. One individual was working part-time outside of the home.

Measures

A multidimensional pain and functioning assessment was completed with all participants. This included (a) a demographic and health questionnaire, (b) a general pain assessment tool, (c) the West Haven-Yale Multidimensional Pain Inventory (WHYMPI), (d) the Symptom Checkist-90–Revised (SCL90-R), and (e) the Pain Disability Index (PDI).

The demographic and health questionnaire included standard demographic questions used in previous studies investigating pain (Roy, Thomas, & Makarenko, 1989; Thomas, Roy, & Cook, 1992; Thomas, Roy, Cook, & Marykuca, 1990; Thomas, Roy, & Makarenko, 1989). The questionnaire also obtained information about the individual's MS (see Appendix B for a complete copy of the questionnaire).

The general pain assessment tool is a measure currently being used by the MS Clinic in Winnipeg, MB to assess pain reports in individuals with MS. This tool was adapted by MS Clinic staff (in Winnipeg, MB) with permission from the following sources: McCaffery and Beebe (1989) and the Pain Research Group, Department of Neurology, University of Wisconsin-Madison. The first section of this tool, adapted from McCaffery and Beebe, was used to obtain detailed information about the individuals' experiences with pain, including location of pain, pain intensity, quality, onset, and

duration. The second section, adapted from the Pain Research Group in the Department of Neurology at the University of Wisconsin-Madison, assesses pain intensity using a numeric rating scale ranging from 0, indicating no pain, to 10, indicating pain as bad as you can imagine. In addition, information about current pain treatments, relief due to those treatments, and interference due to pain are also obtained using this questionnaire (see Appendix C for a complete copy of the form).

The West Haven-Yale Multidimensional Pain Inventory (WHYMPI) consists of three separate sections (Kerns, Turk, & Rudy, 1985). The present study used one of these sections that assesses subjects' descriptions of their pain complaints and the effects which pain has on their lives. This portion of the questionnaire consists of a series of 20 questions. Subjects indicate how much each of the statements apply to them on a numeric rating scale ranging from 1, indicating no problem, to 7, indicating an extreme problem. There are five subscales: (a) pain severity, (b) life interference due to pain, (c) perception of life control, (d) affective distress, and (e) social support. Kerns et al. (1985) found that test-retest reliability coefficients for the WHYMPI range from 0.62 to 0.91. The WHYMPI had not been used previously in research on MS-related pain (see Appendix D for a complete copy of the questionnaire).

The Symptom Checklist-90-Revised (SCL90-R; Derogatis, 1983) is a 90-item scale that measures self-reported psychological distress in psychiatric or medical patients. Each item is rated on a scale ranging from 0 (*not at all distressing*), to 4 (*extremely distressing*). There are nine primary symptom scales: (a) somatization, (b) obsessive-compulsive symptoms, (c) interpersonal sensitivity, (d) depression, (e) anxiety, (f) phobic anxiety, (g) psychoticism, (h) paranoid ideation, and (i) hostility. The SCL90-R also

provides three global indices of psychological distress: (a) positive symptom distress index, (b) positive symptom total, and (c) global severity index (GSI). In this study, the GSI was used as an indication of current distress. The GSI reflects the average severity of distress across all items in the scale. The SCL90-R has been shown to have good internal consistency (0.77 to 0.90) and test-retest reliability (0.78 to 0.90). The SCL90-R has been used in several studies with MS patients (e.g., Jean, Paul, & Beatty, 1999; Mullins et al., 2001). Jean et al. (1999) found that their sample of individuals with MS had an average GSI score of 0.85 ± 0.64, ranging from 0.04 to 2.65 (see Appendix E for a complete copy of the questionnaire).

The Pain Disability Index (PDI) is a 7-item self-report rating scale that assesses disability related to pain in seven categories of life activity (Pollard, 1984). The seven areas assessed are family responsibilities, recreation, social activity, occupational responsibilities, sexual behaviour, self-care, and life support activity. Items are rated on a scale ranging from 1 (*no interference*) to 10 (*total interference*). The total PDI score can range from 0 to 70. This scale has been found to be internally consistent (alpha reliability = 0.87; Pollard). Subsequent reliability in a two month test retest was significant although the correlation ($r = 0.44$) was only moderate (Tait, Chibnall, & Krause, 1990). Validity studies consistently demonstrate high/low physical and verbal disability discrimination between high/low scores on the PDI (see Appendix F for a complete copy of the questionnaire).

Procedure

Pre-Treatment, Post-Treatment, and Follow-Up Assessments

Individuals who met the inclusion criteria and consented to participate in the study, completed the multidimensional pain and functioning assessment, as described above. This assessment was conducted by a trained research assistant not involved in the provision of therapy. The assessment consisted of a one-to-one structured interview, with administration of all questionnaires. This interview took approximately one to two hours to complete for each individual.

Participants were assessed again immediately following intervention and three months following the intervention by the same research assistant who conducted the pre-treatment assessments. All measures administered in the pre-treatment assessment were repeated at these assessments.

Cognitive-Behavioral Group Treatment

The CBT group was of a closed-group format. A total of 10 sessions were scheduled on a weekly basis, with participants being given homework exercises to complete between sessions. Since fatigue has been found to be a significant concern for many individuals with MS (Brassington & Marsh, 1998), the CBT group sessions were limited to one hour in duration (to minimize participants' fatigue). Any participant who missed more than two sessions was invited to complete the group, but his or her data was not included in any of the analyses.

The CBT group material that was used in this study was adapted from a manualized model that had been used with individuals suffering from chronic pain. This particular treatment program has been used in previous research as a 10-session CBT for pain management and is detailed in the book "Managing Pain Before It Manages You" (Caudill, 2002). Research has found that this program has been found to decrease pain

reports, decrease physician visits, decrease depression and anxiety, and increase self-efficacy in individuals with chronic pain (Arnstein, Caudill, Mandle, Norris, & Beasley, 1999; Caudill, Schnable, Zuttermeister, Benson, Friedman, 1991).

A structured treatment protocol as described in Caudill's (2002) book was used to ensure treatment was administered in a standard manner. A summary of the agenda for each session is provided in Appendix G.

The purpose of the first treatment session was to introduce the group members to each other and to the group leader and to help them in starting to become comfortable in the group. The CBT approach to pain management was explained so as to give a basic understanding of the rationale for the group program. Participants were given homework, including keeping daily pain diaries and setting goals.

In session two, participants were introduced to the pathophysiology of pain. Homework included assessing medication use and its side effects, as well as continuing to keep daily pain diaries.

In the third session, participants were taught relaxation techniques such as diaphragmatic breathing and various methods to elicit the relaxation response. Homework for this session was to continue keeping daily pain diaries and practice relaxation techniques regularly.

Participants were taught to pace themselves by alternating rest with activity and to describe physical sensations, including pain, in specific, qualitative terms during session four. As homework, they determined how they currently allocate their time and continued to keep daily pain diaries and practice relaxation techniques.

During session five, participants were taught to identify negative self-talk, challenge those thoughts, and develop more realistic ways of thinking. Homework included daily monitoring of self-talk, dealing with anger and dysfunctional attitudes, and continued use of daily pain diaries and relaxation techniques.

In session six, the focus was on developing more adaptive attitudes (e.g., optimism). Homework involved continuing to monitor and challenge negative thinking, daily relaxation practice, and work on identifying ways to engage in activities that may result in more optimistic or humorous attitudes.

Session seven dealt with developing better nutritional habits. Homework following this session was to keep a daily food diary, as well as monitoring negative thinking and practicing relaxation techniques.

Participants worked on developing better communication skills in session eight (e.g., assertiveness, active listening). Homework involved having individuals practice these communication skills, monitoring negative thinking, and practicing relaxation techniques.

Problem solving skills was the focus of session nine. Finally, in session ten, the focus was relapse prevention and developing a plan for coping with increases in pain to be used in future situations.

To assess possible medication effects, at the beginning of each treatment session, each participant completed several questions regarding when they last took medication and how much they took at that time (see Appendix H). The Medication Quantification Scale III (Harden et al., 2005) was used to objectively quantify each participant's pain medication. This tool was originally developed in 1992 and has been used widely by

clinicians and researchers to track pain medication. There have been several studies which have demonstrated the original tool's concurrent validity and reliability (Harden et al., 2005; Masters-Steedman et al., 1992). Masters-Steedman et al. reported that the initial version of the MQS exhibited high interrater agreement ($r = 0.99$) and strong concurrent validity ($r = 0.76$). A MQS-III score is calculated for each medication by taking a consensus-based detriment weight for a given pharmacologic class and multiplying it by a score for dosage. The calculated values for each medication are then summed for a total score (Harden et al.).

In addition, to determine the amount of work participants engaged in between sessions, at the beginning of each of the 10 sessions, individuals completed an overall rating of how much time they took to practice the skills they had learned during the previous week (see Appendix I).

The primary investigator conducted all treatment sessions. A licensed clinical psychologist conducted regular supervision sessions with the therapist. In addition, an audiotape was made of all treatment sessions, and a random review of the tapes ensured consistency of content and therapist competency (see Appendix J for a copy of the treatment integrity data sheets).

Treatment Credibility

After the first group session, participants completed a treatment credibility rating form (see Appendix K). This form was adapted from Borkovec and Nau (1972) and has been used in group comparison studies of cognitive-behavioral pain management (Kerns et al., 1986). This rating served as an indicator of perceived credibility and expectation

for improvement. This form was re-administered at the end of the 10 group sessions (see Appendix L).

Treatment Integrity

Treatment integrity was evaluated through a procedure commonly used in group comparison studies of pain management programs (Keefe et al., 1990; Kerns et al., 1986). All of the group treatment sessions were audiotaped, and two trained, independent raters were given randomly selected five-minute segments from 30% of the sessions. Raters were asked to listen to the therapist's statements and indicate what the topic for that session was. The percentage of correctly identified segments agreed upon by the two raters served as an indicator of treatment integrity (see Appendix J).

Procedural Reliability

As a means of determining reliability of the procedures administered in the treatment, a checklist was completed by the therapist at the end of every CBT session. Participants in the group also completed this checklist (see Appendices M and N for complete copies of the checklists). The percentage of completed session components agreed upon between the therapist and participants served as an indicator of procedural reliability.

Results

The SPSS/PC version 14.0 computer software program was used for all analyses in this study. In this particular sample, no participant missed more than two sessions, therefore no data was dropped from the following analyses. Three individuals (38%) attended all 10 sessions, four (50%) missed one session, and one individual missed two sessions.

Pre-Treatment Credibility and Expectation for Improvement

After attending the first group session, participants completed five questions assessing perceived credibility of the treatment and expectation for improvement. Ratings could range from 0 to 10, where a higher score indicated increased credibility and expectation for improvement. The average score on this assessment was 8 (*SD* = 1, range = 6.4 to 10).

Post-Treatment Credibility and Satisfaction

After completing the 10 group sessions, participants completed five questions assessing perceived credibility of the treatment and satisfaction with treatment. Ratings could range from 0 to 10, where a higher score indicated increased credibility and satisfaction. The average score on questions assessing treatment credibility was 8.6 (*SD* = 0.6, range = 8 to 9). The average satisfaction score was 9 (*SD* = 0.8, range = 8 to 10).

Homework Completed Between Sessions

Across all 10 treatment sessions, the majority of individuals completed less than four hours of homework each week. Thirty two percent of individuals indicated having completed less than two hours, while 38% indicated that they completed between two and four hours of homework. Twelve percent of individuals completed between four and six hours of homework each week, while 9% completed between six and eight hours and 9% completed between eight and ten hours of homework each week.

Treatment Integrity

Of the randomly selected segments from 30% of the CBT sessions, there was 100% agreement between the two independent raters with respect to identifying the topic for that particular session.

Procedural Reliability

Across all CBT sessions, there was 96% agreement between the therapist and participants with respect to completed session components (*SD* = 6.9, range = 70 to 100%), indicating that CBT procedures were followed by the therapist.

Information Regarding Participants' MS

On average, participants had been diagnosed with MS 11 years prior (*SD* = 9.5, range = 1 to 29 years). Four individuals (50%) had been diagnosed with relapsing-remitting MS, three individuals (38%) with primary-progressive MS, and one individual with secondary-progressive MS.

General Pain Experiences of Participants

Participants reported suffering with pain for an average of six years (*SD* = 4, range = 5 months to 11.5 years). Tables 4, 5, and 6 summarize the general pain-related experiences reported by these eight participants at the three assessment times (pre-treatment, post-treatment, and three-month follow-up).

Across all three assessment times, participants reported experiencing pain in an average of three to four body sites. With respect to location, across all assessments, pain was most frequently experienced in participants' arms/hands, followed by legs and feet.

The majority of participants (between 75% and 88%) were taking medication for their pain at all assessment times. Across the study, the most commonly taken class of medication was anticonvulsants such as Gabapentin and Epival, followed by muscle relaxants such as Baclofen, non-steroidal anti-inflammatory medications such as Advil, and selective serotonin reuptake inhibitors such as Celexa and Prozac. Fewer individuals were taking sedatives such as Immovane, tricyclic antidepressants such as Amitryptyline,

benzodiazepines such as Ativan, schedule II opioids, acetaminophen such as Tylenol, miscellaneous analgesics such as Naproxen, and cannabinoids. Across the study, participants only reported experiencing partial relief of their pain due to medications.

Outcome Measures - Descriptive Statistics

Pain severity.

Severity of one's pain was assessed by two measures, a numeric rating scale ranging from 0 to 10, and the Pain Severity subscale of the WHYMPI, which uses a numeric rating scale ranging from 1 to 7. On both measures, a higher score indicated more severe pain. Pre-treatment, participants reported an average pain severity of 4.3 on the numeric rating scale (*SD* = 1.7, range = 2 to 7). The average on the Pain Severity subscale of the WHYMPI was also 4.3 (*SD* = 1.1, range = 3 to 6.3).

Post-treatment, participants reported an average pain severity of 3.8 on the numeric rating scale (*SD* = 1.8, range = 0 to 5). The average on the Pain Severity subscale of the WHYMPI was 3.6 (*SD* = 1.3, range = 1 to 5.3).

Three months after participating in treatment, participants reported an average pain severity of 3.7 on the numeric rating scale (*SD* = 1.8, range = 1 to 6). The average on the Pain Severity subscale of the WHYMPI was 3.6 (*SD* = 1.4, range = 1.7 to 5.7).

Interference in daily life activities due to pain.

Interference due to pain was assessed by two measures, the Interference subscale of the WHYMPI (scores can range from 1 to 7), and the PDI (total scores can range from 0 to 70). On both measures, a higher score indicated more interference due to pain. At the time of the pre-treatment assessments, on average, participants scored their interference

due to pain on the WHYMPI as 4.3 (*SD* = 1, range = 2.6 to 6.3). The average Total score on the PDI was 35 (*SD* = 10, range = 21 to 54).

At post-treatment, on average, participants scored their interference due to pain on the WHYMPI as 3.9 (*SD* = 1, range = 2.4 to 5). The average Total score on the PDI was 31 (*SD* = 13, range = 20 to 55).

At the three-month follow-up, on average, participants scored their interference due to pain on the WHYMPI as 3.8 (*SD* = 1, range = 2.3 to 5.8). The average Total score on the PDI was 28 (*SD* = 19, range = 2 to 55).

Affective distress.

General affective distress was also assessed by two measures, the Affective Distress subscale of the WHYMPI (scores can range from 1 to 7), and the SCL90-R (Global Severity Index). On both measures, a higher score indicated more distress. The average pre-treatment score on the Affective Distress subscale of the WHYMPI was 3.3 (*SD* = 1, range = 2.3 to 6). The average GSI score was 1.2 (*SD* = 0.7, range = 0.5 to 2.5).

At post-treatment, the average score on the Affective Distress subscale of the WHYMPI was 3 (*SD* = 1, range = 1 to 4.7). The average GSI score was 0.9 (*SD* = 0.6, range = 0.3 to 2).

At three-month follow-up, the average score on the Affective Distress subscale of the WHYMPI was 3.2 (*SD* = 2, range = 1 to 4.7). The average GSI score was 1 (*SD* = 0.5, range = 0.2 to 1.7).

Pre-, Post-, and Follow-up Comparisons of Outcome Measures

Aggregate data.

A series of one-way analysis of variances (ANOVAs) were run to evaluate changes in outcome measures at the three assessment times. Table 7 shows means, standard deviations, and results of the ANOVAs on measures of pain severity, interference due to pain, and affective distress at pre-, post-, and three-month follow-up assessments, across all eight participants. As can be seen in the table, only small, nonsignificant ($p > .05$) variations occurred over time. However, the trend was for scores on each of the outcome measures to decrease after participation in the CBT group and for these scores to remain lower than pre-treatment levels at the three-month follow-up assessment.

To assess for potential medication effects on outcome measures, correlations were run between scores on the MQS-III and pain severity, interference due to pain, and affective distress. Across the course of this study, MQS-III scores were not significantly ($p > .05$) related to the measures of interference due to pain and pain severity (although on the measures of interference there were moderate positive correlations with medication use). There was also no significant relationship between MQS-III scores and SCL90-R GSI scores. There was however a significant, positive correlation found between medication use and affective distress (as measured by the WHYMPI), indicating that the more pain medications and/or higher dosages of medications one was taking, the more distressed one reported feeling (see Table 8 for correlation coefficients). As all of the correlations between medication use and outcomes were in the positive direction (indicating that higher MQS-III scores were associated with higher symptoms), it was concluded that medication use was not accounting for the observed decreases in outcome measures throughout the course of this study.

Individual changes.

Changes in outcome measures at the individual level were also assessed as there appeared to be considerable variability in participants' scores. Figures 1 to 3 present each participant's scores on all outcome measures at pre-, post-, and three-month follow-up assessments. (Raw data can be found in Table 9.) Figures 4 to 6 present the percentage of individuals exhibiting no change in outcome, a decrease in scores (representing a decrease in symptoms), or an increase in scores (representing an increase in symptoms) for each outcome measure. In these figures three comparisons are made: (a) changes in outcome from pre- to post-treatment (seen in Figure 4), (b) changes in outcome from pre-treatment to follow-up (seen in Figure 5), and (c) changes in outcome from post-treatment to follow-up (seen in Figure 6). As can be seen, at least half of all participants reported experiencing a decrease in symptoms in all outcome measures at post-treatment as compared to pre-treatment measures (ranging from 50% to 87.5% of participants). At least half of all participants (ranging from 50% to 87.5% of participants) also reported a decrease in symptoms at the three-month follow-up as compared to pre-treatment on five of the six outcome measures. However, fewer participants reported decreases in symptoms at three-month follow-up as compared to post-treatment. More specifically, at least half of the participants (ranging from 50% to 62.5% of participants) exhibited decreases in symptoms on four of the six outcome measures. The four outcome measures included pain severity (as measured by the WHYMPI), interference due to pain (as measured by the WHYMPI), interference due to pain (as measured by the PDI), and affective distress (as measured by the SCL90-R).

Discussion

The present study extended previous research conducted on the use of CBT for chronic pain management. This study confirmed that it may be feasible to administer a group-based CBT program for MS-related pain management. However, it must be emphasized that recruiting participants for this study was a significant issue. For those individuals who were identified as potential participants but decided not to participate in this study, reasons for not becoming involved in the research included transportation difficulties and concerns about the amount of time required to attend group sessions.

Those who did take part in the CBT intervention, prior to treatment, reported experiencing long-term pain (average duration of six years) across several body sites (average of three pain locations per individual). Participants reported moderate levels of pain severity, interference due to pain, and affective distress. The majority of participants were taking some type of medication for their pain prior to participating in the CBT group, but reported only moderate relief provided by medications. Similar to the findings of Ehde and Jensen's 2004 study on the effects of a cognitive restructuring program for individuals with pain related to a disability, the present study found that, after participating in the 10-session CBT group program, across all eight participants, there were small decreases across all outcome measures (pain severity, interference due to pain, and affective distress). However, these decreases were not statistically significant. It also appeared that at a three-month follow-up, scores on outcome measures remained at a lower level than those reported at the pre-treatment assessment. Overall, participants' medication use did not change significantly across the study. The CBT group was positively received by participants. Satisfaction ratings collected following the group were high (average rating of 9 out of 10). Participants also regularly attended group

sessions with seven of the eight individuals either attending all 10 sessions or only missing one session. Participants regularly completed homework exercises, with the majority of individuals completing less than four hours of homework each week, on average.

It appears that the pain-related experiences reported by this sample of individuals with MS is comparable to that reported in previous research. Prior to participating in the CBT program, this group of individuals reported experiencing pain in an average of three body sites. This is consistent to the results of Archibald et al.'s 1994 study in which their sample reported experiencing pain in an average of 2.8 body sites. Similarly, this study and the earlier research conducted by Archibald et al., Beiske et al. (2004), and Ehde et al. (2003) found that the two most frequent pain locations reported by participants were the arms and legs. The present sample of individuals reported slightly less severe pain (prior to intervention) than that reported by Archibald et al. and Ehde et al. (the respective average severity ratings were 4.3, 5.8, and 5.2 using an 11-point rating scale).

Although the results from the present study are consistent with previous research on the use of CBT with MS (Ehde & Jensen, 2004) and other chronic pain conditions, they are limited due to the small sample size and lack of a comparison or control group. Ideally, one would want to recruit a much larger sample and complete a randomized trial comparing CBT to another treatment or to a waitlist control (as was initially proposed in the design of the present study). Therefore, although the results of this pilot study are promising in that they suggest that CBT could be useful for MS-related pain, the difficulties which were encountered in the recruitment phase and the considerable

variability observed in individuals' treatment responses emphasize the need for one to consider other research design options which may be useful in further studies.

STUDY 2: EXAMINING THE EFFECTS OF CBT ON MS-RELATED CHRONIC PAIN USING A SINGLE-CASE RESEARCH DESIGN

Much of the published research evaluating the effectiveness of psychological interventions has utilized randomized, group comparison designs. Over the past several decades, however, single-case research designs have been more widely used within psychology. In 1995, the Division 12 Task Force on Promotion and Dissemination of Psychological Procedures published a report on empirically validated treatments and identified single-case research designs as meeting the criteria for these treatments. This report identified "well-established treatments" as meeting one of the following two criteria:

1. At least two good between group design experiments demonstrating efficacy in one or more of the following ways: a) superior to pill or psychological placebo or to another treatment, or b) equivalent to an already established treatment in experiments with adequate statistical power (about 30 per group).
2. A large series of single case design experiments (in which the samples include at least nine participants) demonstrating efficacy. These experiments must have: a) used good experimental designs, and b) compared the intervention to another treatment (i.e., pill, psychological placebo, or other treatment). Additionally, it was specified that experiments must be conducted with treatment manuals, that characteristics of the client samples must be clearly specified, and that effects must have been demonstrated by at least two different investigators or investigatory teams.

The task force also identified "probably efficacious treatments" as those meeting one of three criteria:

1. Two experiments showing the treatment is more effective than a waiting-list control group.
2. One or more experiments meeting all of the well-established treatment criteria noted above, except the criterion stating that the effects must have been demonstrated by at least two different investigators
3. A small series of single case design experiments (in which the samples include at least three participants) and these experiments must be conducted with treatment manuals and must clearly specify characteristics of client samples.

Given the difficulties in recruitment encountered in Study 1, it would appear that another viable design option for research in the area of MS-related pain would be to conduct a single-case research study in which each participant would serve as his or her own control. A single-case research design would also be useful in further MS research as there appeared to be considerable variability in symptom change across individuals in the pilot study. Single-case research would allow for a more intensive analysis of individual differences in MS-related pain and changes following intervention.

Supportive of this argument, a Special Topics Series appeared in a 2005 issue of the Clinical Journal of Pain on the topic of single-case research designs in pain research and highlighted their potential for evaluating more customized pain treatments (Onghena & Edgington, 2005). Despite this statement and the above-mentioned statement identifying single-case research designs as meeting criteria for empirically validated treatments, a review of the chronic pain research literature revealed only two recent

studies examining the effectiveness of a cognitive-behavioral intervention that used a single-case design. They will be described below.

Vlaeyen, de Jong, Geilen, Heuts, and van Breukelen (2001) reported using a single-case crossover design to assess the effectiveness of a graded exposure in vivo treatment comparing it to a graded activity treatment. In this study, four participants completed 21 days of baseline measures, after which they were randomly assigned to begin one of the two treatments, which was then followed by the second treatment (each treatment phase lasted for 22 days). In single-case design terminology, this study could be thought of as an A-B-C design, where "A" is a baseline phase, and "B" and "C" are the two intervention phases. Throughout the study period, participants completed 11 questions at the same time each day using 11-point visual analogue scales. These 11 questions were extracted from three existing questionnaires and represented main factors of the outcome measures (pain-related fear and catastrophizing). In addition to these daily measurements, full versions of several standardized pain-related questionnaires were administered at baseline, before beginning the first treatment phase, before beginning the second treatment phase, and upon finishing the second treatment phase. The daily measures of pain-related cognitions and fears were analyzed using visual inspection and time series analysis and it was observed that improvements on outcome measures occurred during one of the treatments (graded exposure in vivo). Pre-post treatment differences were also analyzed and these analyses indicated that the graded exposure in vivo treatment resulted in decreases in pain-related fear, pain catastrophizing, and pain disability.

A follow-up study conducted by de Jong et al. (2005) included eight chronic pain patients. After a two-week baseline phase, these participants took part in two interventions, psychoeducation (one to two weeks duration) and graded exposure in vivo (10 weeks). Finally, at a six-month follow-up, participants completed one week of assessment. Therefore, this study consisted of an A-B-C-D design (where "D" is the six-month follow-up period). Similar to Vlaeyen et al.'s 2001 study, participants completed daily assessments of pain intensity, pain-related fear, pain catastrophizing, and activity goal achievement. These daily assessments were made using 14 visual analogue scales. The first 11 scales were identical to those questions used in the 2001 study. Pain intensity and activity achievement were also measured using 11-point visual analogue scales. Standardized questionnaires were administered before and after each intervention and at six-month follow-up. Results indicated that the graded exposure in vivo treatment was associated with decreases in pain-related fear, pain intensity, and pain disability. These benefits were maintained at the six-month follow-up. Taken together, these studies demonstrate the usefulness of single-case research designs in studying the effects of psychological treatments for chronic pain.

A second point to consider when planning future research in this area is the use of statistical analyses. Relying solely on statistics does not provide any information about the proportion of individuals who benefit from an intervention to a clinically significant degree. One alternative statistical method proposed by Jacobson and Truax (1991) is the "reliable change index" (RCI). This method uses the test-retest reliability of an outcome measure to construct a confidence interval around an individual's pre-treatment assessment score. This confidence interval defines the limits within which post-treatment

scores are expected to change by chance. Post-treatment scores that fall outside of this confidence interval are viewed as clinically reliable individual changes. Two benefits of using this type of change index include: (a) in clinical research and/or practice, it may be useful in case evaluation and management to identify clinically significant changes for each individual participating in an intervention; and (b) improvement and deterioration rates can be calculated which may provide more meaningful information regarding the use of a particular intervention (Wilson, Petersen, Montuoro, & Robert, 1997). This methodology has been used in a number of published studies investigating the effects of group-based CBT programs. These studies will be described below.

In 1998, a study of 67 individuals with fibromyalgia found that after participating in a four-week, interdisciplinary outpatient treatment (which included six, one-hour group CBT sessions, in addition to three medical sessions, four physical therapy sessions, and six occupational therapy sessions), 42% of individuals showed clinically significant improvements on the Pain Severity subscale of the WHYMPI (Turk, Okifuji, Sinclair, & Starz, 1998). Somewhat different results were reported by Wilson et al. (1997), although this difference might be accounted for by the use of different measures of pain severity. Wilson et al. (1997) found that none of the 72 individuals with chronic pain showed reliable improvements on the Pain Intensity subscale of the McGill Pain Questionnaire (Short Form) after participating in a nine-week group CBT program. However, they did find that 36% of individuals improved on a measure of knowledge of pain management, 27% improved on the MQS (medication usage), 18% improved on a measure of disability (measured by the Roland-Morris Disability Questionnaire), and 24% improved on a measure of depression (measured by the Beck Depression Inventory). Currie, Hodgins,

Crabtree, Jacobi, and Armstrong (2003) reported that within their sample of individuals with concurrent chronic pain and substance abuse disorders, clinically significant change indices were modest following participation in a 10-week cognitive-behavioral group treatment focusing on chronic pain management, substance education, and relapse prevention. The proportion of individuals who were identified as having reliably improved from pre-treatment to post-treatment on outcome measures varied: (a) 34% improved on the Life Control subscale of the WHYMPI, (b) 10% improved on the Interference subscale of the WHYMPI, (c) 5% improved on the Affective Distress subscale of the WHYMPI, and (d) 25% improved on the McGill Pain Questionnaire (a measure of pain severity). Finally, Currie, Wilson, and Curran (2002) investigated improvement in insomnia within a group of 51 individuals suffering from chronic nonmalignant pain who participated in a CBT program. Although this study did not include any pain measures in its outcomes, the proportion of individuals who were identified as having reliably improved at post-treatment and a three month follow-up on outcome measures varied, ranging from 45% improved on a measure of sleep quality at three month follow-up to 8% improved on a measure of total sleep time at follow-up.

In sum, these studies demonstrate that a single-case research design and the use of the reliable change index (RCI) are potentially useful within chronic pain research.

Purpose of Present Study

The primary purpose of this study was to provide an evaluation of the effectiveness of a CBT intervention for pain management for MS-related pain using a single-case research design. Outcome measures included self-reported pain severity, interference in daily life activities due to pain, and affective distress.

A secondary purpose of this study was to obtain information on the social support obtained by this group of pain patients and the relationship this support may have with the outcome measures. For the purpose of this discussion, social support received by others is conceptualized as being comprised of three major components (emotional, informational, and instrumental supports; Coyne & DeLongis, 1986). Emotional support could include having someone to talk with or provide emotional comfort. Informational support would be just that, receiving wanted information. Finally, instrumental support could include practical support such as financial assistance or help completing daily life activities.

In the general chronic pain literature, there have been varying reports on the impact of perceived social support and satisfaction with support on physical and psychological health. A great deal of research within this area has studied individuals with rheumatoid arthritis (RA), a group of chronic pain patients which may be comparable to MS patients as both groups often experience symptoms such as pain, extreme fatigue, and mood disturbance. Therefore, this research will be briefly reviewed in the following section.

Overall, there seems to be beneficial effects of support received on one's psychological well-being within this group of pain patients. Fitzpatrick, Newman, Lamb, and Shipley (1988) found that in a group of 158 individuals with RA the greater one's social relationships, the less one reported feeling depressed. Similarly, Doeglas et al. (1994) reported that in their sample of 54 individuals with RA more social support received daily was related to decreased depression. Finally, it has also been reported that

higher levels of support received from one's spouse in particular is related to lower levels of depression (Revenson & Majerovitz, 1991).

With respect to the effects of social support on pain severity and disability due to pain, there also appears to be benefits to individuals who perceive themselves as receiving high levels of support. Several studies have reported that support received and satisfaction with such support is related to decreased reports of pain (pain frequency and severity) related to rheumatoid arthritis (Savelkoul, Post, de Witte, & van den Borne, 2000; Waltz, Kriegel, & van'tPad Bosch, 1998). Recent research has provided additional evidence for the short- and long-term benefits of social support. Evers, Kraaimaat, Geenen, Jacobs, and Bijlsma (2003) found that in a group of 78 individuals with RA, low levels of social support at the time of one's diagnosis of arthritis predicted higher levels of pain (frequency and severity) and disability at three year and five year follow-ups. In summary, the research using RA samples has consistently found beneficial effects of social support on one's psychological well-being (e.g., depression), severity of one's pain, and one's level of disability.

Holtzman, Newth, and DeLongis (2004) extended these findings by including measures of satisfaction and disappointment with social support received and examined the effect that these two measures might have on pain-related variables. These relationships appear to be quite complex. In this study, Holtzman et al. (2004) found that satisfaction and disappointment with social support was not directly related to self-reported pain severity. Instead, satisfaction and disappointment with support affected pain severity ratings indirectly, by impacting the use of various maladaptive and adaptive coping strategies. Greater satisfaction with one's social support was related to increased

use of a variety of coping strategies (both adaptive and maladaptive strategies), while disappointment with support tended to be related to increased use of maladaptive coping strategies. Furthermore, these authors found that satisfaction with social support also influenced pain reports by increasing the effectiveness with which individuals were able to employ pain-related coping strategies.

Surprisingly, within the MS research literature, relatively few authors have reported on the effects of social support. In 1990, Wineman reported that, in a sample of 118 adults with MS, there was no direct relationship between perceived supportiveness of one's social network and depression or MS-related disability. More recent research involving individuals with MS has examined the effect of perceived support and interference due to pain. In two such studies, these two variables were not found to be statistically related (Ehde et al., 2003; Osborne et al., 2006). Although these few studies have not found any relationship between support and pain-related variables in MS samples, social support does seem to be an important variable in understanding the experiences of more general chronic pain samples.

Therefore, the present study planned to further explore perceived social support in a group of MS patients who were also experiencing chronic pain. General supportiveness related to one's pain was assessed as well as satisfaction and disappointment with one's social support. The relationship between these aspects of social support and pain severity, interference due to pain, and affective distress was examined. This research also assessed levels of social support, and satisfaction and disappointment with support before, during, and after participating in the CBT group program.

Hypotheses

The present study hypothesized that, when data was analyzed on a case-by-case basis, there would be: (a) significantly less severe pain, (b) significantly less pain-related physical disability and interference, and (c) significantly less psychological distress reported during treatment and post-treatment phases as compared to the baseline phase. Statistically, as well as clinically, significant decreases in symptoms were hypothesized.

It was also hypothesized that, when examining pre-treatment measures, levels of pain-related social support would be negatively correlated with levels of general psychological distress and pain severity. No significant relationship between overall social support and interference due to pain was hypothesized.

Method

Study Design

Ethical approval for this study was received from the University of Manitoba, as well as the Health Sciences Centre in Winnipeg, MB prior to its start. This study used a multiple baseline experimental design across participants to evaluate the treatment.

In this study, all participants were assigned to no-treatment baseline periods ranging from two to six weeks, followed by the treatment phase (group CBT program) of 10 weeks, and a follow-up phase of four weeks. As in Study 1, participants also completed a more in-depth multidimensional pain assessment pre-treatment, post-treatment, and at a three month follow-up with a research assistant.

More specifically, in this study, participants completed a baseline phase of two, four, or six weeks in duration. In traditional single-case designs the baseline period is typically extended until stable trends in most outcome measures are observed. However, because participants in the present study were taking part in a group-based therapy

program (of a closed-group format), meaning that individuals in a given group all began treatment at the exact same time, it was necessary to have a pre-determined end to each participant's baseline phase.

Assignment to the three baseline periods (either two, four, or six weeks) was based on time of recruitment. Hence, the first five individuals recruited for this study were assigned to the two-week baseline phase, while the next five individuals recruited were assigned to the four-week baseline phase, and the last four individuals recruited were assigned to the six-week baseline phase.

Participants and Recruitment

Fourteen adults with a diagnosis of MS were recruited for this study. At the MS Clinic in Winnipeg, MB, potential participants were identified by the clinical nurse specialist. In an attempt to increase participant numbers, the following additional steps were taken to recruit potential participants: (1) a research poster with tear-off slips was placed at the offices of the MS Society - Manitoba Division (see Appendix O for a copy of this poster), (2) a notice about the research was placed in MS Society's newsletter which was sent to all members of the MS Society in Manitoba (see Appendix P for a copy of this notice), (3) a notice about the research was placed in a newsletter published by the Manitoba Medical Association (see Appendix Q), and (4) an advertisement was placed in a weekend edition of the Winnipeg Free Press (see Appendix R).

The same criteria for referral of potential participants used in Study 1 was used in this study. For those potential participants recruited through sources outside of the MS Clinic, the primary investigator relied on self-report with respect to meeting inclusion

criteria. For example, individuals self-identified as fulfilling the criteria for a definite diagnosis of MS as well as cognitive functioning intact or mild impairment.

The primary researcher met briefly with each of the eligible participants to describe the study in more detail and obtain informed consent if the individual agreed to participate (see Appendix S for a complete copy). Participants were given an honorarium of $25 to assist in costs relating to transportation.

Measures

A multidimensional pain and functioning assessment was completed with all participants. This included five of the same measures used in Study 1: (a) a demographic and health questionnaire, (b) a general pain assessment tool, (c) the West Haven-Yale Multidimensional Pain Inventory (WHYMPI), (d) the Symptom Checkist-90–Revised (SCL90-R), and (e) the Pain Disability Index (PDI).

In addition to these previously-used measures, the present study also included two questions to assess one's satisfaction and disappointment with social support (see Appendix T for a copy of these two questions). These questions have been used in previous chronic pain research (Holtzman et al., 2004). This measure was designed by Holtzman et al. and assesses satisfaction and disappointment with three dimensions of social support (emotional, informational, and instrumental). For both of these questions the number of sources of support are summed to create a total score for satisfaction with support and a total score for disappointment with support.

Finally, an open-ended question was asked of participants ("Has anything else happened in the past several days that has had any effect on you, good or bad?"). This

question was added to help interpret unexpected changes in outcome measures, if necessary.

Procedure

Pre-Treatment, Post-Treatment, and Follow-Up Assessments

The same procedures used in Study 1 to complete the pre-, post-, and follow-up assessments were used in the present study. In Study 2, these assessments also included the two questions on satisfaction and disappointment with social support.

Ongoing Assessments

During baseline, treatment, and post-treatment phases, the primary investigator telephoned each participant twice per week to complete a 22-item questionnaire (see Appendix U). For this particular assessment, questions were taken from the WHYMPI. The WHYMPI includes five subscales (Interference, Support, Pain Severity, Life Control, and Affective Distress) and the extracted questions from this test represented items from the Pain Severity, Interference, Support, and Affective Distress scales. The two questions which assessed satisfaction and disappointment with one's social support, as well as the open-ended question described previously were also included. Finally, the investigator also collected information on pain medication taken by each participant in the past 24 hours. As in Study 1, pain medication taken was quantified using the MQS III.

The questions used in these ongoing assessments were worded so that each individual provided a verbal rating of symptoms during the past 24 hours. In the assessment of pain, research has shown that a verbal rating scale is as sensitive to changes in clinical pain as compared to the widely used visual analogue scale (Jensen,

Miller, & Fisher, 1998). The verbal rating of pain however is much easier to administer, easier for participants to understand, and has been found to be useful in the assessment of pain in individuals with cognitive difficulties (Closs, Barr, Briggs, Cash, & Seers, 2004).

These ongoing assessments were completed by means of phone calls rather than face-to-face meetings due to transportation difficulties many individuals with MS reported in the recruitment phase of this study. [This barrier to participation was also noted by Ehde and Jensen (2004)]. The duration of each of these phone assessments was limited to approximately 20 minutes; therefore it seemed unreasonable to expect that each participant should have to attend a face-to-face meeting to collect this information. Although previous studies have used daily pain diaries which individuals complete on their own at home, in this study that did not seem feasible given that some of the individuals with MS may have difficulty completing lengthy written exercises due to physical limitations. As a control measure, the investigator attempted to make phone calls to each participant on the same days of the week, at the same time of day to avoid any potential effects of day or time of day. A literature review indicated that other pain research has used phone interviews as a means of data collection (Edwards, Telfair, Cecil, & Lenoci, 2000; Lerner et al., 1999; Sabbioni & Eugster, 2001).

Cognitive-Behavioral Group Treatment

The same CBT group material and procedures used in Study 1 were used in this study. As in the previous study, to assess possible medication effects, at the beginning of each session, each participant completed several questions regarding when they last took medication and how much they took at that time. Again, the MQS-III was used to objectively quantify each participant's pain medication. In addition, to determine the

amount of work participants engaged in between sessions, at the beginning of each of the 10 sessions, individuals completed an overall rating of how much time they took to practice the skills they had learned during the previous week (see Appendix V). In the present study, this question regarding homework completed was revised and did not represent a categorical variable. This was done so that more exact data on homework completion could be identified (for example, if a participant had completed one hour of homework, using Study 1's homework question this would have been identified as "0 - 2 hours", but using the current questioning the participant would identify "1").

Treatment Credibility, Integrity, and Procedural Reliability

The same measures of treatment credibility (see Appendices K and L), treatment integrity (see Appendix J), and procedural reliability (see Appendices M and N) used in Study 1 were used in the present study.

Data Analysis

The SPSS/PC version 14.0 computer software program was used for all analyses in this study. Descriptive statistics were obtained for overall demographic characteristics of participants (e.g., age, gender, marital status, employment status, education level, and ethnicity), MS-related variables (e.g., MS subtype and duration of disease), general pain-related variables (e.g., pain medication usage, location of pain, duration of pain, and social support received related to pain), as well as for the three outcome variables (pain severity, interference due to pain, and affective distress).

Analyses Conducted on Ongoing Assessment Data (Multiple Baseline Design)

Analysis of the ongoing assessment data consisted of three steps. Visual inspection of data is the criterion used most frequently to evaluate data from single-case

designs (Kazdin, 1982), therefore this method of analysis was employed in this study. However, statistical analyses have also been used in single-case research to supplement evaluation through visual inspection. Kazdin stated that statistical analyses can be useful if data is highly variable (i.e., there is an unstable baseline), when the investigation is of a new research area, or when small changes between phases may be important. Given that all three of these issues were prevalent in the present research, it was decided that appropriate statistical analyses of the data would also be undertaken in this study.

Standard tests (such as *t* tests or ANOVAs) which compare the level of symptoms across two or more phases of a study typically cannot be conducted on single-case data since the assumption of independent error terms may be violated (Onghena & Edgington, 2005). If serial dependency exists in the data, this indicates that the error terms are not independent. Therefore, the first step in this stage of the analyses was to conduct a test for serial dependency in which an autocorrelation statistic is calculated to determine if adjacent data points are correlated to each other. A statistically significant autocorrelation ($p < .05$) would indicate that there is a significant amount of serial dependency within the data, therefore one would be unable to conduct standard *t* tests or ANOVAs. In the present study, autocorrelations were computed separately for each participant's data for each of the three phases of the study for each of the three outcome variables. In cases in which no significant serial dependency was detected in all of the three phases, simple one-way ANOVAs were conducted to determine if there were significant changes between levels of symptoms in baseline, treatment, and post-treatment phases. In cases where a significant change was observed between phases, post-hoc comparisons were conducted to determine which specific phases differed. Tukey comparisons were

conducted for data in which there were equal variances; Dunnett T3 comparisons were conducted for data in which there were unequal variances. The Bonferoni method was used to adjust for Type I error rate due to the considerable number of analyses which were conducted for each participant (significance was set at $p < .01$).

In cases in which serial dependency is detected, time series analyses are typically conducted to determine if there is a statistically significant change in level and trend from one phase to the next. However, it has been suggested by many authors that the reliability of results from time series analyses depend on the number of data points within each phase, with estimates ranging from 20 to 100 measurements per phase (Box and Jenkins, 1970; Kazdin, 1982). As the participants in this study would only have a maximum of 12 data points reported during the baseline phase, followed by 20 data points in the treatment phase, and eight data points in the post-treatment phase, it was decided for the purpose of this study that time series analyses would not be used for participants' data exhibiting significant autocorrelation. Therefore, if significant autocorrelation was detected in participants' data, visual inspection would be the only evaluation strategy utilized for these particular individuals.

To assess clinically meaningful changes in outcomes, the "reliable change index" (RCI), as outlined by Jacobson and Truax (1991) was calculated. This method uses the test-retest reliability of an outcome measure to construct a confidence interval around an individual's pre-treatment assessment score. The confidence interval defines the limits within which post-treatment scores are expected to change by chance. Post-treatment scores that fall outside of this confidence interval are viewed as clinically reliable individual changes. According to Jacobson and Truax, the formula for the RCI is: RCI =

$(x_2 - x_1)/ S_{diff}$, where x_1 represents an individual's pre-test score, x_2 represents the same individual's post-test score, and S_{diff} is the standard error of the difference between the two test scores. The spread of the distribution of change scores that would be expected if no real change occurred between the pre-test and post-test assessments is described by S_{diff}. To calculate S_{diff}, one can use the formula: $\sqrt{2}\ (S_E)^2$, where S_E is the standard error of measurement. S_E is equal to: $s_1\ \sqrt{1 - r_{xx}}$, where s_1 is the standard deviation of the pre-treatment scores on the measure of interest and r_{xx} is the test-retest reliability of the measure. If the resulting RCI is less than -1.96 (or larger than 1.96, depending on the direction of change), a participant is considered to have reliably improved from pre-test to post-test assessment times (Jacobson & Truax). A RCI > 1.96 or a RCI < -1.96 would be unlikely to occur without an actual change ($p < 0.05$; Jacobson & Truax). Therefore, the RCI indicates if a change in scores is more than that which would be expected by normal fluctuations in the measurement tool. The RCI methodology for analyzing data necessitates that one uses measures which have good test-retest reliabilities (Wilson et al., 1997). Therefore, in the present study, RCIs were calculated for the following outcome measures: (a) WHYMPI - Pain Severity subscale (test-retest reliability = 0.82), (b) WHYMPI - Interference subscale (test-retest reliability = 0.69), and (c) WHYMPI - Affective Distress subscale (test-retest reliability = 0.86). In the present study, each individual's data for each phase (baseline, treatment, and post-treatment) was averaged, and these phase means were used in the RCI calculations.

Results

Final Sample of Participants

Although 14 adults were initially recruited for this study, four of these individuals dropped out of the study following the pre-treatment assessment interview. One of these individuals was unable to be contacted to determine the reason for withdrawal, however the remaining three individuals reported that they decided not to participate in the intervention because of the time commitment required and/or transportation issues. Of the 10 individuals who completed the CBT group program, one participant missed more than two group sessions (missing four sessions in total), therefore this individual's data was dropped from the final analyses.

When statistical analyses (t-tests and chi-square analyses) were conducted comparing the characteristics of those completing treatment and those who did not, it was found that the group of individuals completing treatment ($N = 9$) was not statistically different from the five individuals who did not complete treatment on any of the pre-treatment outcome measures (pain severity, interference due to pain, and affective distress) or on any of the MS disease variables (including MS subtype and disease duration). Completers and noncompleters also did not differ significantly with respect to characteristics including medication use, gender, age, marital status, ethnicity, employment status, and education level (see Tables 10 and 11 for detailed comparisons of completers and noncompleters). The Bonferoni method was used to adjust for Type I error rate due to the considerable number of analyses which were conducted ($p < .003$).

In the final sample of nine individuals, only one individual (11%) attended all 10 sessions, six individuals (67%) missed one session, and two individuals (22%) missed two sessions. The sample consisted of three men (33%) and six women (67%) with a mean age of 51 years ($SD = 12$, range = 42 to 75 years). All of the participants were

caucasian. The majority (67%) were married; three individuals were in common-law relationships (33%). Within the sample, the mean number of years of education completed was 15 (*SD* = 3.5, range = 12 to 20 years). The majority (78%) of individuals were not working outside of the home. One individual was working part-time outside of the home, while another individual was working full-time outside the home. On average, participants had been diagnosed with MS 15 years prior (*SD* = 15, range = 2.5 to 46 years). Five individuals (56%) had been diagnosed with relapsing-remitting MS and one individual with secondary-progressive MS. The remaining three individuals reported that they did not know what MS subtype they had been diagnosed with. On average, participants had been experiencing pain for 8.5 years (*SD* = 6, range = 1.5 to 22 years).

This study did not exclude participants who experienced other health conditions that may also result in pain. However, overall this group of nine individuals did not report any other current medical conditions, with six individuals reporting no current health issues (other than MS). However, one participant reported having a hiatus hernia, a condition which can result in acute pain. One other individual reported having a hiatus hernia, Type II diabetes, occasional kidney stones, and Reiter's syndrome (an arthritic condition resulting in joint pain). Lastly, one individual reported having a hiatus hernia as well as macular degeneration.

Of the nine participants comprising the final sample, six individuals were recruited through the MS Clinic in Winnipeg and three individuals were recruited through local newspaper advertisements and posters at the offices of the local chapter of the MS Society. A series of t-tests and chi-square analyses compared the "clinic" participants with the three "community" participants. The two groups did not differ significantly on

the pain severity, affective distress, and interference due to pain outcome measures. They also did not differ significantly with respect to MS subtype and disease duration. Clinic and community participants did not differ significantly with respect to characteristics including medication use, gender, age, ethnicity, employment status, and education level (see Tables 12 and 13 for detailed comparisons of those participants recruited through the MS clinic and community sources). The Bonferoni method was used to adjust for Type I error rate due to the considerable number of analyses which were conducted ($p < .003$).

Pre-Treatment Credibility and Expectation for Improvement

After attending the first group session, participants completed five questions assessing perceived credibility of the treatment and expectation for improvement. Ratings could range from 0 to 10, where a higher score indicated increased credibility and expectation for improvement. The average score on this assessment was 8 ($SD = 2$, range = 3 to 10).

Post-Treatment Credibility and Satisfaction

After completing the 10 group sessions, participants completed five questions assessing perceived credibility of the treatment and satisfaction with treatment. Ratings could range from 0 to 10, where a higher score indicated increased credibility and satisfaction. The average score on questions assessing treatment credibility was 8.6 ($SD = 2$, range = 3 to 10). The average satisfaction score was 9 ($SD = 2$, range = 3 to 10).

Homework Completed Between Sessions

Across all 10 treatment sessions, the average number of hours spent doing homework each week was 2 ($SD = 0.7$, range = 0.8 to 3 hours).

Treatment Integrity

Of the randomly selected segments from 30% of the CBT sessions, there was 100% agreement between the two independent raters with respect to identifying the topic for that particular session.

Procedural Reliability

Across all CBT sessions, there was 95% agreement between the therapist and participants with respect to completed session components (*SD* = 14, range = 30 to 100%), indicating that CBT procedures were followed by the therapist.

General Pain-Related Experiences

Tables 14, 15, and 16 summarize the general pain-related experiences reported by these nine participants at the three assessment times (pre-treatment, post-treatment, and three-month follow-up). Information for all of these tables was obtained through the one-to-one structured interviews participants completed with a trained research assistant.

Across the study, the most frequently reported pain locations tended to be consistent and included legs, feet, and arms/hands. The majority of participants were taking some type of medication for their pain at all three assessment times (89% at pre-treatment, 67% at post-treatment, and 67% at three-month follow-up), however participants reported only experiencing partial pain relief through medications (64% relief at pre-treatment, 56% at post-treatment, and 43% at three-month follow-up). Across the study, the two most commonly taken classes of medications were selective serotonin reuptake inhibitors (such as Celexa) and schedule II opioids (such as Oxycontin and various forms of morphine).

With respect to social support received, this study included three measures which were not included in Study 1 (the Social Support subscale of the WHYMPI and the two

questions assessing satisfaction and disappointment with support). On the Social Support subscale of the WHYMPI, a higher score indicated a perception of more support received. At all three assessment times, this sample of nine participants, on average, reported receiving moderate levels of social support (means ranging from 4.9 to 5.5 on a scale from 1 to 7; see Table 14). Overall, on the Social Support subscale of the WHYMPI, there were small decreases in perceived supportiveness across the study. However, at all three assessment interviews, the majority of participants reported being satisfied with at least one source of support (89% at pre-treatment, 100% at post-treatment, and 100% at three-month follow-up). In addition, across the study, most participants reported not being disappointed with any source of social support (67% at pre-treatment, 89% at post-treatment, and 89% at follow-up). There were very small changes in the average number of support sources with which participants were satisfied and disappointed with over the course of the study (see Table 14).

To explore potential relationships between the three social support measures (perceived support received related to one's pain, satisfaction with support received, and disappointment with support received) and interference due to pain, pain severity, and distress, a series of Pearson product moment correlations were run on the pre-treatment data collected. As hypothesized, there was a slight negative correlation between perceived social support received and measures of pain severity and affective distress, indicating that the more supported one felt with respect to his or her pain, the less severe pain one reported and the less severe distress one reported. Both of these correlations were nonsignificant however ($p > .05$). Contrary to the hypotheses made, however, the measure of perceived support received was negatively correlated with interference due to

pain (a nonsignificant but moderate correlation), indicating that the more supported one felt, the less interference due to pain was reported. Following previous research findings, it had been hypothesized that there would be no relationship between support and pain interference.

There was also a moderate (but nonsignificant) negative correlation between satisfaction with one's support and affective distress, indicating that the more sources of support one was satisfied with, the lower his or her self-reported distress was. Low to moderate (but not significant) positive correlations were found between satisfaction with support and interference due to pain as well as pain severity, indicating that the more sources of support with which one was satisfied with, the more interference and severe pain one also reported. Furthermore, there were low to moderate positive correlations between disappointment with support and measures of pain severity and affective distress (although nonsignificant). This would indicate that the more sources of support one felt disappointed in, the more severe pain severity and distress one also reported. Finally, there was no relationship found between disappointment with support and interference due to pain (see Table 17 for a listing of all correlations).

Results from Ongoing Assessments

This study utilized a multiple baseline design across participants in which data on the three outcome measures (interference due to pain, pain severity, and affective distress) was collected twice weekly with participants throughout the course of three phases (baseline, treatment, and post-treatment). Graphical presentation of this data is presented in Figures 7 to 12. Figures 7 to 12 represent the level of symptoms for each participant over time. The mean level of symptoms for each phase of the study is

represented in these figures as a broken, horizontal line within the phase. Phase means for each participant on the four study measures (interference due to pain, pain severity, affective distress, and medication use) are also presented in Table 18.

Although not included in this study as an outcome measure, pain medication use was also collected throughout the three phases (baseline, treatment, and post-treatment) using the MQS-III and this data is presented in Figures 13 and 14. This data was examined to explore any potential effects pain medications might have had on the three outcome variables. The medication data was analyzed for statistically significant changes across the course of the study. Since the version of the MQS which was used in the present study is a new version for which there is no published test-retest reliability coefficient, clinically significant differences could not be calculated for this measure.

Participants 1 to 4 were the first four individuals recruited for this study and were therefore assigned to a two-week baseline phase, followed by the 10-week treatment phase, and a four-week post-treatment phase. Participants 5 to 7 were the subsequent individuals recruited to the study and therefore comprised the second group of participants, thereby completing the four-week baseline phase, followed by the 10-week treatment phase, and the four-week post-treatment phase. Participants 8 and 9 were the last individuals recruited and were assigned to the last group which completed a six-week baseline phase, followed by the 10-week treatment phase, and the four-week post-treatment phase.

Visual inspection of data: Within participant comparisons.

Participant 1.

Participant 1 (P1) was a 52-year-old, married woman. She had a high school education. At the time of the study, she was not working outside the home. P1 had been diagnosed with MS 20 years prior. At the pre-treatment assessment, she indicated that she had not been told of having a particular MS subtype. She had difficulties with ambulation, using either a cane or wheelchair. At the time of the pre-treatment assessment, she reported suffering from pain for the past eight years. At that time she reported pain in her head, feet, legs, arms, torso, and back. Her head pain was described as feeling like her head was going to "explode". P1 reported a "stabbing" pain in her back, "pricking" sensations in her torso, "numbness" in her feet and legs, and "pins and needles" and/or "burning" pain in her arms. At the post-treatment interview, she reported pain in her feet, legs, arms, torso, and back. Her pain descriptors had not changed since the pre-treatment interview. P1 attended all 10 group CBT sessions and completed, on average, two hours of homework per week.

Figures 7, 9 and 11 display the results of the twice weekly assessments completed with P1 throughout the two-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that the mean level of self-reported pain severity decreased slightly while P1 was attending the CBT group sessions as compared to the baseline phase. There appeared to be very little difference between treatment and post-treatment phases on this measure. With respect to affective distress, there also appeared to be a decrease in distress reported during the treatment phase of the study (observed in the last four weeks of treatment). A further decrease in distress symptoms was observed during the post-treatment phase. Lastly, contradicting the hypotheses of this study, P1 reported an increase in interference due to

pain during treatment as compared to baseline assessments and this high level of interference continued throughout the post-treatment phase. Visual inspection of P1's medication use throughout the course of the three phases revealed that there was a decrease in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 13).

Participant 2.

Participant 2 (P2) was a 42-year-old woman. She was in a long-term common-law relationship. P2 had completed post-secondary education. At the time of the study, she was not working outside the home. P2 had been diagnosed with relapse-remitting MS six years prior, although at the time of the pre-treatment assessment, she reported suffering from pain for the past 10 years. At this initial assessment, she reported pain in her head, feet, legs, arms, torso, and back. Her head pain was described as being "throbbing" or "aching". P2 reported an "aching" pain in her back, "burning" pain in her torso, "aching" and "sharp" pain in her legs, "burning" and "cramping" pain in her feet, and "burning" pain in her arms. At the post-treatment interview, she reported pain in all of the same six locations noted in the pre-treatment assessment. Her pain descriptors had not changed since the pre-treatment interview. P2 attended nine of the 10 group CBT sessions and completed, on average, 1.3 hours of homework per week.

Figures 7, 9, and 11 display the results of the twice weekly assessments completed with P2 throughout the two-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that the level of self-reported pain severity appeared to decrease slightly while P2 was attending the CBT group sessions as compared to the baseline phase. There

appeared to be very little difference between treatment and post-treatment phases on this measure. It should be noted however that there was a large amount of variability in P2's pain severity reports throughout all three phases of this study, making conclusions regarding the impact of the intervention difficult to make. With respect to affective distress, there appeared to be a decrease in distress during treatment as compared to the baseline phase. This decrease was maintained during the post-treatment phase of assessment. However, as can been seen in Figure 11, P2's level of distress also decreased during the baseline phase of the study which would suggest that factors other than the CBT program may have contributed to the changes in distress seen in the treatment and post-treatment phases of study. Lastly, contradicting the hypotheses of this study, P2 reported an increase in interference due to pain during treatment as compared to baseline assessments and this high level of interference continued throughout the post-treatment phase. Variability in data on interference due to pain however makes interpretation of these results difficult. Visual inspection of P2's medication use throughout the course of the three phases revealed that there was a decrease in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 13).

Participant 3.

Participant 3 (P3) was a 43-year-old woman. She was in a long-term common-law relationship. P3 had a high school education. At the time of the study, she was not working outside the home. P3 had been diagnosed with relapse-remitting MS almost four years prior. She had difficulties with ambulation, using either a cane or wheelchair. At the time of the pre-treatment assessment, she reported suffering from pain for the past 3.5 years. At this interview she reported pain in her head, feet, legs, arms, torso, and back.

Her head pain was described as feeling like her head had a "tight band" around it. P3 reported a "burning" pain in her back, "numb" sensations in her torso, "cramping" in her feet, and "numbness" in her arms. At the post-treatment interview, she reported pain in her head, feet, legs, arms, and back. In addition to the pain descriptors she used to describe her pain in the pre-treatment interview, at post-treatment P3 also said that she experienced an "electrical" sensation in her arms and a "burning" pain in her legs. P3 attended nine of the 10 group CBT sessions and completed, on average, 1.4 hours of homework per week.

Figures 7, 9, and 11 display the results of the twice weekly assessments completed with P3 throughout the two-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that P3's level of self-reported pain severity did not appear to change while she was attending the CBT group sessions as compared to the baseline phase, although there was a slight decrease in mean pain severity reported during the post-treatment phase of the study. With respect to affective distress, there seemed to be an increase in mean distress during the treatment phase of the study, compared to the baseline phase. However, there was a dramatic decrease in distress reported by P3 during the last week of treatment and distress remained at this level during the post-treatment phase. This dramatic change may be accounted by the resolution of some relationship issues that P3 had been dealing with during the previous several months. Lastly, P3 reported an increase in interference due to pain during treatment as compared to baseline assessments and this high level of interference continued throughout the post-treatment phase. Visual inspection of P3's medication use throughout the course of the three phases revealed that

there was a decrease in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 13).

Participant 4.

Participant 4 (P4) was a 49-year-old, married man. He had completed post-secondary schooling. At the time of the study, he was not working outside the home. P4 had been diagnosed with relapse-remitting MS almost five years prior. However, at the time of the pre-treatment assessment, he reported suffering from pain for the past nine years. At this interview he reported pain in his head, feet, legs, arms, and torso. His head pain was described as "stabbing" and/or "twitching" ocular pain and general "aching" pain. P4 reported "burning" sensations in his torso, "twitching" and/or "cramping" in his feet, "burning" pain in his legs, and "burning" pain and/or "numbness" in his arms and hands. At the post-treatment interview, he reported pain in his feet, legs, arms, and torso. His pain descriptors had not changed since the pre-treatment interview. P4 attended nine of the 10 group CBT sessions and completed, on average, 1.5 hours of homework per week.

Figures 7, 9, and 11 display the results of the twice weekly assessments completed with P4 throughout the two-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that the level of self-reported pain severity decreased slightly while P4 was attending the CBT group sessions as compared to the baseline phase. During the post-treatment phase of the study, further decreases in pain severity were also noted. The same pattern was observed in P4's self-reported affective distress, although the decreases in distress seemed to be more significant than the decreases in pain severity. Lastly,

contradicting the hypotheses of this study but similar to the results of the three other participants in this group, P4 reported an increase in interference due to pain during treatment as compared to baseline assessments. However, during the post-treatment phase there was a very small decrease in the level of interference reported by P4. Visual inspection of P4's medication use throughout the course of the three phases revealed that there was a decrease in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 13).

Participant 5.

Participant 5 (P5) was a 75-year-old, married man. He had a high school education. At the time of the study, he had been retired for 18 years. P5 had been diagnosed with MS 46 years prior. At the pre-treatment assessment, he indicated that he had not been told of having a particular MS subtype. He had difficulties with ambulation and typically used a cane or walker. At the time of the pre-treatment assessment, he reported suffering from pain for almost two years. At this interview he reported only experiencing back pain which he described as being a "constant aching". This was the only type of pain he was experiencing again at the post-treatment interview. P5 attended nine of the 10 group CBT sessions and completed, on average, two hours of homework per week.

Figures 8, 10, and 12 display the results of the twice weekly assessments completed with P5 throughout the four-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that, contrary to the hypotheses made, the level of self-reported pain severity increased while P5 was attending the CBT group sessions as compared to the baseline

phase, but then decreased to baseline levels during the post-treatment phase of the study. With respect to affective distress, the phase means for baseline, treatment, and post-treatment phases did not appear to be considerably different. Lastly, P5 reported an increase in interference due to pain during treatment (seen especially in week three of treatment) as compared to baseline assessments and this high level of interference continued throughout the post-treatment phase. Visual inspection of P5's medication use throughout the course of the three phases revealed that there was virtually no change in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 14).

Participant 6.

Participant 6 (P6) was a 44-year-old woman. She was in a long-term common-law relationship. She had a high school education. At the time of the study, she was working in a part-time job outside of the home. P6 had been diagnosed with relapse-remitting MS nearly 16 years prior. She had some difficulties with ambulation and typically used a cane. In addition to MS, P6 also reported having a hiatus hernia. At the time of the pre-treatment assessment, she reported suffering from pain for the past 6.5 years. At this interview she reported pain in her feet and legs. Her leg pain was described as "twitching" and/or "burning" sensations. She also stated that her feet felt like they were "constantly burning" and when walking she felt as if she was "walking on crushed glass". At the post-treatment interview, she reported experiencing the same type of painful sensations in her feet and legs. P6 attended nine of the 10 group CBT sessions and completed, on average, three hours of homework per week.

Figures 8, 10, and 12 display the results of the twice weekly assessments completed with P6 throughout the four-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that, contrary to expectations, the level of self-reported pain severity increased while P6 was attending the CBT group sessions as compared to the baseline phase. There appeared to be very little difference between treatment and post-treatment phases on this measure. It was noted however that there was a high level of variability in pain severity reported by P6 throughout the entire study making comparisons between phases difficult. With respect to affective distress, although again there was considerable variability in distress reported, it appeared that the level of distress decreased during treatment, as compared to baseline. There appeared to be very little change in phase means between treatment and post-treatment phases. However, as can be seen in Figure 12, P6's level of distress also decreased in the baseline phase of the study which would suggest that factors other than the CBT program may have contributed to the changes in distress seen in the treatment and post-treatment phases. Lastly, P6 reported a slight decrease in interference due to pain during treatment as compared to baseline assessments, however there was an increase in interference during the post-treatment phase of the study. Visual inspection of P6's medication use throughout the course of the three phases revealed that there was very little change in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 14).

Participant 7.

Participant 7 (P7) was a 67-year-old, married woman. She had completed post-secondary education. At the time of the study, she was not working outside the home. P7

had been diagnosed with MS nearly 28 years prior. At the pre-treatment assessment, she indicated that she had not been told of having a particular MS subtype. She had difficulties with ambulation and regularly used a cane. In addition to MS, P7 also reported having a hiatus hernia and macular degeneration. P7 did not report any interference in reading materials relating to the CBT group sessions due to the macular degeneration. At the time of the pre-treatment assessment, she reported suffering from pain for the past 22 years. At this interview she reported pain in her head, feet, legs, arms, and back. Her head pain was described as a "burning" and/or "throbbing" pain. P7 reported a sensation of "heat" in her back, "burning" and/or electrical sensations in her feet, "burning" and/or "crawling" sensations in her legs, and "tingling" and/or "burning" pain in her arms and hands. At the post-treatment interview, she reported experiencing the same pain sensations in her feet, legs, arms, and back. P7 attended nine of the 10 group CBT sessions and completed, on average, two hours of homework per week.

Figures 8, 10, and 12 display the results of the twice weekly assessments completed with P7 throughout the four-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that on all three outcome measures (pain severity, affective distress, and interference due to pain) there appeared to be virtually no change in the level of self-reported symptoms between all phases of the study. Visual inspection of P7's medication use throughout the course of the three phases revealed that there was a decrease in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 14).

Participant 8.

Participant 8 (P8) was a 42-year-old, married woman. She had completed post-secondary studies. At the time of the study, she was working full-time outside the home. P8 had been diagnosed with secondary-progressive MS nearly three years prior. At the time of the pre-treatment assessment, she reported that although her MS diagnosis had been relatively recent, she had been suffering from pain for the past five years. She reported pain in her head, feet, legs, and arms. Her head pain was described as being a "stabbing" and/or "throbbing" pain. P8 described "burning" and/or "tingling" sensations in her legs, "burning" pain in her arms, and "sharp" pains in her feet. At the post-treatment interview, she reported pain in her feet, legs, arms, and head. Her pain descriptors had not changed since the pre-treatment interview. P8 attended eight of the 10 group CBT sessions and completed, on average, 0.80 hours of homework per week.

Figures 8, 10, and 12 display the results of the twice weekly assessments completed with P8 throughout the six-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that the level of self-reported pain severity was approximately the same while P8 was attending the CBT group sessions as compared to the baseline phase, but decreased slightly during the post-treatment phase. With respect to affective distress, there appeared to be a decrease in symptoms during treatment as compared to baseline, and this decrease was maintained during the post-treatment phase. Lastly, P8 reported slightly less interference due to pain during treatment as compared to baseline assessments. Interference due to pain reported during the post-treatment phase was similar to that observed in the treatment phase of the study. However, it should be noted that on the measures of affective distress and interference due to pain there was a high level of

variability in P8's data, making comparisons between the three phases of the study difficult. Furthermore, as can be seen in Figures 10 and 12, the levels of distress and interference reported by P8 also decreased during the baseline phase of the study which would suggest that factors other than the intervention may have contributed to changes seen on these measures in the treatment and post-treatment phases. Visual inspection of P8's medication use throughout the course of the three phases revealed that there almost no change in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 14).

Participant 9.

Participant 9 (P9) was a 47-year-old, married man. He had completed post-secondary education. At the time of the study, he was not working outside the home. P9 had been diagnosed with relapse-remitting MS six years prior. In addition to MS, P9 also reported having a hiatus hernia, Type II diabetes, occasional kidney stones, and Reiter's syndrome (i.e., Reiter's arthritis). At the time of the pre-treatment assessment, he reported suffering from pain for the past 10 years. At this interview he reported pain in his head, feet, legs, arms, torso, and back. His head pain was described as "aching" and he experienced "sharp" ocular pain. P9 reported sharp pains in his back, "burning" sensations in his torso, "aching" and/or "weakness" in his feet and legs, and "numbness" and/or "burning" pain in his arms and hands. At the post-treatment interview, he reported pain in his head feet, legs, arms, and torso. His pain descriptors had not changed since the pre-treatment interview. P9 attended eight of the 10 group CBT sessions and completed, on average, two hours of homework per week.

Figures 8, 10, and 12 display the results of the twice weekly assessments completed with P9 throughout the six-week baseline phase, the 10-week treatment phase, and the four-week post-treatment phase. Visual inspection of these graphs revealed that the level of self-reported pain severity did not seem to change while P9 was attending the CBT group sessions as compared to the baseline or post-treatment phases. With respect to affective distress, the trend during the treatment phase was for distress to increase over the 10 weeks of treatment and during post-treatment. Lastly, P9 reported an increase in interference due to pain during treatment as compared to baseline assessments and this high level of interference continued throughout the post-treatment phase. Visual inspection of P9's medication use throughout the course of the three phases revealed that there was a decrease in pain medication used during treatment and post-treatment phases, as compared to the baseline phase (see Figure 14).

Visual inspection of data: Between participant comparisons.

As noted by Barlow, Hayes, and Nelson (1984), when making comparisons within a single participant across simple phase changes (as was done in the preceding section), the possibility always remains that an extraneous variable may coincide with phase changes which could result in the observed changes in the dependent variable. Therefore, the multiple baseline design across participants attempts to provide some degree of experimental control over maturational effects, life events, and other extraneous variables by showing that each participant improves when treatment is introduced, despite treatment being applied at different points in time (Hersen & Barlow, 1976). The following sections summarize comparisons between participants on the three outcome measures.

Pain severity.

Although when visually inspecting participants pain severity data in Figures 7 and 8, it would initially appear that for three individuals (P1, P2, and P4) pain severity decreased during the treatment phase of the study, these results were not replicated across the remaining six participants in this study. Furthermore, P2's level of pain severity had already begun to decrease during the baseline phase which would indicate that some other factor(s) may have contributed to the decreases seen in this participant's data during the treatment phase. Finally, it must be noted that all of these three participants who reported decreased pain severity during treatment, began the treatment phase of this study at the exact same time and participated in the same intervention group. Because a similar pattern of results was not observed across the other groups of participants, it would seem unlikely that the change in pain severity which was observed in these three individuals was actually due to the CBT program. Therefore, it may be concluded that, contrary to the hypotheses made, this intervention did not result in any change in self-reported pain severity by these nine participants.

Interference in daily life activities due to pain.

When visually inspecting participants' interference data in Figures 9 and 10, it appeared that only two individuals (P6 and P8) reported a decrease in interference due to pain during the treatment phase of this study. However, P8's data on this measure was highly variable, calling into question any conclusions made regarding changes seen. In contrast, most participants in this study (P1, P2, P3, P4, P5, P7, and P9) reported increases in interference during the treatment phase of study. Although P2's data was variable throughout the study (making conclusions regarding treatment effects difficult to

make), the other five participants showed increased interference with the introduction of treatment, despite treatment being applied at different points in time. Therefore, it may be concluded that, contrary to hypotheses made, this intervention did not result in decreased interference in daily life activities due to pain, and in fact, led to increased interference in daily life activities.

Affective distress.

Although when visually inspecting participants' affective distress data in Figures 11 and 12, it would initially appear that for five individuals (P1, P2, P4, P6, and P8) distress decreased during the treatment phase of the study, these results were not replicated across the remaining four participants. Furthermore, the level of distress reported by P2 and P6 had begun to decrease during the baseline phase of the study which would indicate that some other factor(s) may have contributed to their decreased distress during the intervention phase of study. Lastly, the level of distress reported by P8 was variable throughout the study phases making it difficult to make any strong conclusions regarding treatment effects. Therefore, it would appear that this CBT program may have resulted in decreased affective distress for only two of these nine participants, contrary to hypotheses made.

Statistically and clinically significant changes in individual data.

Participant 1.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P1's data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P1's data during any of the phases ($r = 0$ during baseline, $r = 0.25$ during treatment, and $r = -0.11$ during post-

treatment). On the measure of pain severity, there was no significant ($p > .05$) serial dependency detected in P1's data during any of the phases ($r = -0.15$ during baseline, $r = 0.18$ during treatment, and $r = 0.37$ during post-treatment). On the measure of affective distress, there was no significant ($p > .05$) serial dependency detected in P1's data during any of the phases ($r = -0.25$ during baseline, $r = 0.34$ during treatment, and $r = -0.6$ during post-treatment).

A series of one-way ANOVAs were run to statistically evaluate changes between phases. No statistically significant difference between phases was found on the measure of pain severity [$F(2, 28) = 3.7, p = 0.04$]. Statistically significant differences between phases were found on remaining two outcome measures: (a) interference due to pain [$F(2, 28) = 56.5, p = 0.000$], and (b) affective distress [$F(2, 28) = 19.9, p = 0.000$]. On the measure of interference due to pain, post-hoc comparisons indicated that there were significant differences between baseline and treatment phases ($p = 0.000$) and between baseline and post-treatment phases ($p = 0.000$), with both treatment and post-treatment phase means being significantly greater than that during baseline. No significant differences were found between treatment and post-treatment phases ($p = 0.38$) on this measure. On the measure of affective distress, significant differences were found between baseline and post-treatment phases ($p = 0.000$) and between treatment and post-treatment phases ($p = 0.000$), with distress being less during the post-treatment phase. No significant differences were found between the mean affective distress reported during baseline and treatment phases ($p = 0.62$).

Results from the RCI analyses indicated that between baseline and treatment phases, there were clinically significant decreases ($p < 0.05$) in the average level of

symptoms reported on measures of pain severity (RCI = -4.0) and affective distress (RCI = -5.6). However, there was also a clinically significant increase in the average level of interference during this same time (RCI = 14.3). Comparing changes between baseline and post-treatment phases, again, there were clinically significant decreases on the measures of pain severity (RCI = -4.0) and affective distress (RCI = -31.1), but significant increases in interference due to pain (RCI = 12.7).

With respect to medication use, there was significant autocorrelation found in P1's data during the post-treatment phase (r =-0.1 during baseline, r = 0.2 during treatment, and r = 1.0 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses revealed that P1's medication use decreased throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

Taken as a whole, these analyses indicated that the CBT group sessions may have resulted in clinically (but not statistically) significant decreases in P1's self-reported pain severity, but surprisingly, also resulted in statistically and clinically significant increases in interference due to pain reported by P1. With respect to P1's self-reported affective distress, the phase means for baseline and treatment phases were not found to be statistically different. Affective distress had decreased significantly (statistically) however by the post-treatment assessment phase. On the RCI calculations it was found that P1's distress decreased by a clinically significant amount during treatment and post-treatment phases as compared to baseline.

Participant 2.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P2's data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P2's data during any of the phases ($r = 0$ during baseline, $r = 0.32$ during treatment, and $r = 0.21$ during post-treatment). However, on the measure of pain severity, there was significant ($p < .05$) serial dependency detected in P2's data during the treatment phase ($r = 0.16$ during baseline, $r = 0.49$ during treatment, and $r = 0.1$ during post-treatment). Similarly, on the measure of affective distress, there was significant ($p < .05$) serial dependency detected in P2's data during the treatment phase ($r = 0.15$ during baseline, $r = 0.67$ during treatment, and $r = -0.36$ during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P2's data on the measure of interference due to pain, a one-way ANOVA was run to statistically evaluate changes between phases. A statistically significant difference between phases was found [$F(2, 26) = 5.3, p = 0.01$]. Post-hoc comparisons indicated that on the measure of interference, there was a significant difference between baseline and post-treatment phases ($p = 0.01$), with the post-treatment phase mean being significantly greater than that during baseline. No significant difference was found between baseline and treatment phases ($p = 0.03$) and between treatment and post-treatment phases ($p = 0.42$) on this measure.

Results from the RCI analyses indicated that between baseline and treatment phases, there were no clinically significant changes ($p > 0.05$) in the average level of symptoms reported on all three outcome measures: (a) pain severity (RCI = -0.83), (b) interference due to pain (RCI = 1.7), and affective distress (RCI = -1.3). Comparing

changes between baseline and post-treatment phases, there was no clinically significant change on the measure of pain severity (RCI = -0.71). However, there was a significant decrease on the measure of affective distress (RCI = -2.8), but also a significant increase in interference due to pain (RCI = 2.4).

With respect to medication use, there was significant autocorrelation found in P2's data during the baseline phase (r =1.0 during baseline, r = 0.0 during treatment, and r = 0.4 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses revealed that P2's medication use decreased throughout the course of the study, it was assumed that the use of medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

These analyses indicated that although there were no clinically significant changes in all three outcomes when treatment and baseline phases were compared for P2, at post-treatment, there was a clinically significant decrease in distress but also a significant increase in interference. There was also a clinically significant decrease in distress reported during the post-treatment phase as compared to the baseline phase.

Participant 3.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P3's data. On the measure of interference due to pain, there was significant ($p < .05$) serial dependency detected in P3's data during the treatment phase (r = -0.04 during baseline, r = 0.59 during treatment, and r = 0.45 during post-treatment). However, on the measure of pain severity, there was no significant ($p > .05$) serial dependency detected in P3's data during any of the phases (r = -0.29 during

baseline, r = -0.18 during treatment, and r = -0.08 during post-treatment). Similarly, on the measure of affective distress, there was no significant ($p > .05$) serial dependency detected in P3's data during any of the phases (r = -0.19 during baseline, r = 0.41 during treatment, and r = -0.25 during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P3's data on the measures of pain severity and affective distress, a series of one-way ANOVAs were run to statistically evaluate changes between phases. There were no statistically significant differences between phases found on the measure of pain severity [F (2, 26) = 4.2, p = 0.03]. However, statistically significant differences between phases was found on the measure of affective distress [F (2, 26) = 18.3, p = 0.000]. On the measure of affective distress, significant differences were found between baseline and post-treatment phases (p = 0.01) and between treatment and post-treatment phases (p = 0.000), with distress being less during the post-treatment phase. No significant difference was found between the mean affective distress reported during baseline and treatment phases (p = 0.36).

Results from the RCI analyses indicated that between baseline and treatment phases, there were no clinically significant changes ($p > 0.05$) in the average level of symptoms reported on measures of pain severity (RCI = 0.11) and affective distress (RCI = 1.7). However, there was a clinically significant increase in the average level of interference during this same time (RCI = 7.4). Comparing changes between baseline and post-treatment phases, there was no clinically significant change on the measure of pain severity (RCI = -0.9). However, there was a significant decrease in affective distress (RCI

= -4.1) at post-treatment. There was also a significant increase in interference due to pain (RCI = 7.0) at post-treatment.

With respect to medication use, there was significant autocorrelation found in P3's data during baseline and post-treatment phases (r =1.0 during baseline, r = 0.02 during treatment, and r = 1.0 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since the visual analyses revealed that P3's medication use decreased throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

In sum, these analyses indicated that the CBT group sessions did not seem to result in statistically significant decreases on the pain severity and affective distress measures reported by P3, however P3's self-reported affective distress had decreased significantly (both statistically and clinically) by the time of the post-treatment phase. Similar to the pattern observed with both Participants 1 and 2, P3 also reported clinically significant increases in the level of interference due to pain during the treatment and post-treatment phases of this study as compared to the baseline phase.

Participant 4.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P4's data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P4's data during any of the phases (r = -0.11 during baseline, r = 0.38 during treatment, and r = 0.04 during post-treatment). However, on the measure of pain severity, there was significant ($p < .05$) serial dependency detected in P4's data during the baseline and treatment phases (r = 1.0

during baseline, $r = 0.59$ during treatment, and $r = -0.02$ during post-treatment). Similarly, on the measure of affective distress, there was significant ($p < .05$) serial dependency detected in P4's data during the treatment phase ($r = -0.34$ during baseline, $r = 0.6$ during treatment, and $r = -0.02$ during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P4's data on the measure of interference due to pain, a one-way ANOVA was run to statistically evaluate changes between phases. Statistically significant differences between phases were found [$F(2, 26) = 20.3, p = 0.000$]. Post-hoc comparisons indicated that there was a significant difference between baseline and treatment phases ($p = 0.004$), with the mean level of interference reported during the treatment phase of the study being significantly greater than that reported during the baseline phase. There was also a significant difference found between treatment and post-treatment phases ($p = 0.000$), with the mean level of interference during the treatment phase being significantly greater than that reported during the post-treatment phase. No significant difference was found between baseline and post-treatment phases ($p = 0.52$) on this measure.

RCI calculations were unable to be completed on P4's pain severity data as the standard deviation of his baseline data was zero. Results from the RCI analyses on measures of interference and distress indicated that between baseline and treatment phases, there was a clinically significant decrease ($p < 0.05$) in the average level of symptoms reported on the measure of affective distress (RCI = -8.2). However, there was also a clinically significant increase in the average level of interference during this same time (RCI = 2.9). Comparing changes between baseline and post-treatment phases, again, there was a clinically significant decrease on the measure of affective distress (RCI =

-15.7). At post-treatment, there was no significant change in interference due to pain (RCI = -1.1) as compared to baseline.

With respect to medication use, there was significant autocorrelation found in P4's data during the baseline and post-treatment phases (r =1.0 during baseline, r = 0.5 during treatment, and r = 1.0 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses indicated that P4's medication use decreased throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

These analyses indicated that the CBT group sessions may have resulted in statistically and clinically significant increases in interference due to pain reported by P4. However, there were also clinically significant decreases in distress reported by P4 during the treatment and post-treatment phases of the study.

Participant 5.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in the data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P5's data during any of the phases (r = -0.04 during baseline, r = 0.32 during treatment, and r = -0.08 during post-treatment). However, on the measure of pain severity, there was significant ($p < .05$) serial dependency detected in P5's data during the treatment and post-treatment phases (r = -0.48 during baseline, r = 0.45 during treatment, and r = 1.0 during post-treatment). Similarly, on the measure of affective distress, there was significant ($p < .05$) serial

dependency detected in P5's data during the baseline phase (r = -0.68 during baseline, r = 0.15 during treatment, and r = -0.02 during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P5's data on the measure of interference due to pain, a one-way ANOVA was run to statistically evaluate changes between phases. Statistically significant differences between phases were found [F (2, 30) = 11.9, p = 0.000]. Post-hoc comparisons indicated that there was a significant difference between baseline and treatment phases (p = 0.006), with the mean level of interference reported during the treatment phase of the study being significantly greater than that reported during the baseline phase. There was also a significant difference found between treatment and post-treatment phases (p = 0.002), with the mean level of interference during the post-treatment phase being significantly greater than that reported during the treatment phase. Lastly, there was a significant difference found between baseline and post-treatment phases (p = 0.000), with the mean level of interference during the post-treatment phase being significantly greater than that during the baseline phase.

Results from the RCI analyses indicated that between baseline and treatment phases, there were clinically significant increases ($p < 0.05$) in the average level of symptoms reported on measures of pain severity (RCI = 9.4) and affective distress (RCI = 2.4). There was no clinically significant change in the average level of interference due to pain during this same time (RCI = 0.1). Comparing changes between baseline and post-treatment phases, again, there was a clinically significant increase in affective distress (RCI = 2.4). There were no significant changes in pain severity (RCI = 1) or interference (RCI = 0.2) during post-treatment.

With respect to medication use, there was significant autocorrelation found in P5's data during the all phases (r =1.0 during baseline, r = 0.002 during treatment, and r = 1.0 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses indicated that P5's medication use did not change greatly throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

These analyses indicated that the CBT group sessions may have resulted in a statistically significant increase in interference due to pain reported by P5, although this was not a clinically significant change. Results also showed that the CBT sessions may have resulted in clinically significant increases in P5's distress and pain severity.

Participant 6.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P6's data. On the measure of interference due to pain, there was significant ($p < .05$) serial dependency detected in P6's data during the treatment phase (r = -0.1 during baseline, r = 0.46 during treatment, and r = 0.52 during post-treatment). Similarly, on the measure of pain severity, there was significant ($p < .05$) serial dependency detected in P6's data during the treatment phase (r = 0.11 during baseline, r = 0.56 during treatment, and r = -0.28 during post-treatment). Similarly, on the measure of affective distress, there was significant ($p < .05$) serial dependency detected in P6's data during the treatment phase (r = 0.18 during baseline, r = 0.47 during treatment, and r = -0.13 during post-treatment). As there was significant ($p < .05$) serial dependency detected in P6's data, no further statistical analyses were conducted.

Results from the RCI analyses indicated that between baseline and treatment phases, there were no clinically significant changes ($p > 0.05$) in the average level of symptoms reported on measures of pain severity (RCI = 1.5) and affective distress (RCI = -1.7). However, there was a clinically significant decrease in the average level of interference during this same time (RCI = -2.7). Comparing changes between baseline and post-treatment phases, again, there was no clinically significant change on the measure of pain severity (RCI = 1.8). There was also no significant change in interference due to pain (RCI = -0.3). There was however a significant decrease in affective distress (RCI = -2.1) at post-treatment.

With respect to medication use, there was significant autocorrelation found in P6's data during the baseline and treatment phases (r =1.0 during baseline, r = 1.0 during treatment, and r = -0.02 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses revealed that P6's medication use did not change greatly throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

These analyses indicated that the CBT group sessions may have resulted in a clinically significant decrease in interference due to pain. There was no significant change in pain severity and affective distress during the treatment phase of the study, however by the post-treatment phase, affective distress had decreased by a clinically significant amount.

Participant 7.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P7's data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P7's data during any of the phases ($r = -0.39$ during baseline, $r = 0.15$ during treatment, and $r = 0.53$ during post-treatment). Similarly, on the measure of affective distress, there was no significant ($p > .05$) serial dependency detected in P7's data during any of the phases ($r = -0.16$ during baseline, $r = 0.43$ during treatment, and $r = 0.11$ during post-treatment). However, on the measure of pain severity, there was significant ($p < .05$) serial dependency detected in P7's data during the post-treatment phase ($r = -0.38$ during baseline, $r = 0.23$ during treatment, and $r = 1.0$ during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P7's data on the measures of interference and distress, a series of one-way ANOVAs were run to statistically evaluate changes between phases. There were no statistically significant differences between phases found on both measures: (a) interference due to pain [F (2, 30) = 0.32, $p = 0.73$], and (b) affective distress [F (2, 30) = 0.26, $p = 0.77$].

Results from the RCI analyses indicated that between baseline and treatment phases, there were no clinically significant changes ($p > 0.05$) in the average level of symptoms reported on all outcome measures: (a) pain severity (RCI = 0.4), (b) interference due to pain (RCI = 0), and (c) affective distress (RCI = 1.1). Comparing changes between baseline and post-treatment phases, again, there were no clinically significant changes on all three measures (a) pain severity (RCI = 1.1), (b) interference (RCI = -0.6), and (c) affective distress (RCI = 1.1).

With respect to medication use, there was significant autocorrelation found in P7's data during the treatment phase ($r = 0.08$ during baseline, $r = 0.5$ during treatment, and $r = -0.02$ during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses revealed that P7's medication use decreased throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

These analyses indicated that the CBT sessions did not have a statistically or clinically significant impact on P7's interference due to pain and affective distress. There was also no clinically significant changes on the measure of pain severity.

Participant 8.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P8's data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P8's data during any of the phases ($r = 0.28$ during baseline, $r = 0.11$ during treatment, and $r = -0.02$ during post-treatment). Similarly, on the measure of affective distress, there was no significant ($p > .05$) serial dependency detected in P8's data during any of the phases ($r = 0.05$ during baseline, $r = 0.17$ during treatment, and $r = -0.26$ during post-treatment) and on the measure of pain severity ($r = 0.33$ during baseline, $r = 0.43$ during treatment, and $r = -0.36$ during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P8's data, a series of one-way ANOVAs were run to statistically evaluate changes between phases. Statistically significant differences between phases were found for all three outcome

measures: (a) interference due to pain [F (2, 32) = 4.9, p = 0.01], (b) pain severity [F (2, 32) = 9.9, p = 0.000], and (c) affective distress [F (2, 32) = 13.3, p = 0.000]. On the measure of interference due to pain, post-hoc comparisons indicated that there were significant differences only between baseline and post-treatment phases (p = 0.004), with interference due to pain being less during the post-treatment phase. No significant differences were found between baseline and treatment phases (p = 0.11) and between treatment and post-treatment phases (p = 0.35) on this measure. On the measure of pain severity, post-hoc comparisons indicated that there were significant decreases in severity between baseline and post-treatment phases (p = 0.001) and between treatment and post-treatment phases (p = 0.004), but not between baseline and treatment phases (p = 0.72). On the measure of affective distress, post-hoc comparisons indicated that there were significant decreases in distress between baseline and treatment phases (p = 0.005) as well as between baseline and post-treatment phases (p = 0.000). There was no difference found between treatment and post-treatment phases (p = 0.05).

Results from the RCI analyses indicated that between baseline and treatment phases, there were no clinically significant changes (p > 0.05) in the average level of symptoms reported on measures of pain severity (RCI = -0.8) and interference due to pain (RCI = -1.3). There was however a significant decrease in affective distress (RCI = -4.7). Comparing changes between baseline and post-treatment phases, there were clinically significant decreases on all three outcome measures: (a) pain severity (RCI = -4.9), interference (RCI = -2.1), and (c) affective distress (RCI = -8).

With respect to medication use, there was significant autocorrelation found in P8's data during the baseline and post-treatment phases (r = 0.6 during baseline, r = 0.2 during

treatment, and $r = 1.0$ during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses indicated that P8's medication use did not vary greatly throughout the course of the study, it was assumed that the use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

Taken as a whole, these analyses indicated that the CBT group sessions may not have resulted in statistically or clinically significant decreases on measures of interference due to pain and pain severity, but these measures did decrease significantly (statistically and clinically) by the time of the post-treatment phase. The CBT group sessions also appeared to result in both statistically and clinically significant decreases in affective distress reported by P8.

Participant 9.

Initially, autocorrelations were run for each phase to determine if there was any significant serial dependency in P9's data. On the measure of interference due to pain, there was no significant ($p > .05$) serial dependency detected in P9's data during any of the phases ($r = 0.11$ during baseline, $r = 0.27$ during treatment, and $r = 0.06$ during post-treatment). Similarly, on the measure of pain severity, there was no significant ($p > .05$) serial dependency detected in P9's data during any of the phases ($r = 0.24$ during baseline, $r = -0.13$ during treatment, and $r = -0.05$ during post-treatment). However, on the measure of affective distress, significant serial dependency was noted during the treatment phase ($r = 0.37$ during baseline, $r = 0.50$ during treatment, and $r = -0.26$ during post-treatment).

As there was no significant ($p > .05$) serial dependency detected in P9's data on the measures of interference and pain severity, a series of one-way ANOVAs were run to statistically evaluate changes between phases. Statistically significant differences between phases were found on the measure of interference [F (2, 34) = 17.2, p = 0.000], but not on the measure of pain severity [F (2, 34) = 0.90, p = 0.42]. On the measure of interference due to pain, post-hoc comparisons indicated that there were significant differences between baseline and treatment phases (p = 0.000) and between baseline and post-treatment phases (p = 0.000), with both treatment and post-treatment phase means being significantly greater that that during baseline. No significant differences were found between treatment and post-treatment phases (p = 0.87) on this measure.

Results from the RCI analyses indicated that between baseline and treatment phases, there was no clinically significant change ($p > 0.05$) in the average level of symptoms reported on measure of pain severity (RCI = -0.5). There was however significant increases on the measures of affective distress (RCI = 2.9) and interference due to pain (RCI = 4.2). Comparing changes between baseline and post-treatment phases, again, there were clinically significant increases on the measures of affective distress (RCI = 5.8) and interference (RCI = 4.7), but no significant changes in pain severity (RCI = 1).

With respect to medication use, there was significant autocorrelation found in P9's data during all phases (r =0.7 during baseline, r = 1.0 during treatment, and r = 1.0 during post-treatment), therefore no statistical analyses were conducted to compare levels of medication use during the three phases. However, since visual analyses indicated that P9's medication use decreased throughout the course of the study, it was assumed that the

use medication for pain symptom control did not have any beneficial effect on the three main outcomes measures.

In sum, these analyses indicated that the CBT group sessions may not have resulted in statistically or clinically significant decreases on the measure of pain severity and surprisingly, resulted in a statistically significant increase in interference due to pain reported by P9. There was also a clinically significant increase in affective distress reported during treatment and post-treatment phases.

Summary of statistically and clinically significant changes in individual data.

Table 19 summarizes statistically significant changes in outcome measures across the three phases of this study (baseline, treatment, and post-treatment) for these nine participants. This table displays significant improvements, deteriorations, as well as no change exhibited by participants. Two comparisons are made in this table: (a) changes in mean levels of symptoms observed between baseline and treatment phases, and (b) changes in mean level of symptoms observed between baseline and post-treatment phases. As a whole, for those participants whose data was analyzed for statistically significant changes, it seemed that there were some statistically significant benefits that may be accounted for by their participation in the CBT group sessions. Most of these benefits appeared to be in the area of affective distress. However, statistically significant decreases in distress did not tend to appear until during the post-treatment assessment phase (i.e., in the month after the intervention program). There did not appear to be statistically significant effects on the measure of pain severity (with the majority of participants reporting no change in this measure both during treatment and post-treatment

phases). Unexpectedly, the majority of these participants reported statistically significant increases in interference due to pain during the treatment and post-treatment phases of this study.

Results of the RCI analyses are displayed in Table 20. This table displays clinically significant (i.e., RCI > 1.96) improvements, deteriorations, as well as no change exhibited by participants. Two comparisons are made in this table: (a) changes in mean level of symptoms observed between baseline and treatment phases, and (b) changes in mean level of symptoms observed between baseline and post-treatment phases. As a whole, it seemed that there were some clinically meaningful benefits that may be accounted for by individuals' participation in the CBT group sessions. Most of these benefits appeared to be in the area of affective distress. However, clinically significant decreases in distress did not tend to appear until during the post-treatment assessment phase (i.e., in the month after the intervention program). There did not appear to be clinically significant effects on the measure of pain severity (with the majority of participants reporting no change in this measure both during treatment and post-treatment phases). Finally, the majority of participants reported either clinically significant increases or no change at all with respect to interference due to pain during the treatment and post-treatment phases of this study.

Discussion

It has long been known that pain often is a significant symptom for individuals suffering from MS. The pain these individuals experience is frequently treated with typical medical management (e.g., medication), however this is not always effective in providing relief for the pain patient. With other chronic pain syndromes, it is now widely

accepted that a multidimensional approach to pain management, addressing not only the physical component to one's pain experience, is optimal. Despite this knowledge, there has been little study into how to effectively manage this symptom in MS beyond the use of medical interventions.

Over the past 25 years, much research has been done which has demonstrated the usefulness of CBT in the management of other chronic pain conditions such as low back pain and pain related to arthritis. The present two studies extended previous research by attempting to examine whether this approach to pain management could be used to effectively manage pain and related variables within a group of MS patients. The first study in this series confirmed that, despite difficulties with participant recruitment, it was feasible to administer a manualized, group CBT program for MS-related pain and, when the data was examined in aggregate form, small decreases were observed in the outcome measures (pain severity, interference due to pain, and affective distress) following 10 weeks of treatment. Study 2 added to these findings by providing a more detailed examination of the pain experiences of a small group of MS patients before, during, and after participating in the same CBT program. Nine individuals participated in this study, using a multiple baseline design across participants. Study 2 confirmed that there may be some benefits to individuals with MS-related pain after participating in the treatment.

General Pain Experiences of Participants

Despite differences in study designs and location of participant recruitment, the pain experiences reported by participants in Studies 1 and 2 were quite similar overall. In both of these studies, prior to participating in treatment, individuals with MS reported experiencing long-term pain (average durations of six and nine years, respectively) across

several body sites (average of three and five pain locations per individual, respectively). The majority of all participants were taking some type of medication for their pain prior to participating in the CBT group, but reported only moderate relief provided by medications. In both studies, participants' medication use did not change greatly across the course of study.

Individuals participating in the current two studies appeared to report similar pain experiences as compared to those reported in previous MS research. Descriptions of pain consistent with neuropathic and musculoskeletal pain were commonly found in Study 2 and these descriptions did not appear to vary across the course of the study. These descriptions are consistent with previous research which has reported that neuropathic and musculoskeletal pain are commonly experienced pain syndromes in MS (Indaco et al., 1994; Kalia & O'Connor, 2005). With respect to pain severity reported prior to participating in the intervention, results from these two studies are similar to those reported by Archibald et al. (1994), Heckman-Stone and Stone (2001), and Ehde et al. (2003) who all found mild to moderate (i.e., ratings of 5 or less on a numeric rating scale of 10) levels of pain intensity reported in their samples of MS patients. Both of the current studies and the earlier study conducted by Archibald et al. also found that the most frequent pain locations reported by participants were the arms, legs, and feet. Although the average number of pain sites reported by participants in Study 1 prior to treatment (mean of three sites) was consistent to the results of Archibald et al.'s study (mean of 2.8 sites), Study 2 participants reported experiencing pain in an average of five body sites. Despite this difference, as already mentioned, Study 2 participants' overall

level of pain severity across all sites was similar to that reported in Study 1 and previous MS research.

In Study 2, it would appear from the descriptions of pain experienced that the majority of participants (eight out of nine individuals) reported pain throughout the course of the study which may be neuropathic in nature (e.g., pain described as "burning", "pins and needles", or "numbness" typically experienced in one's extremities). The majority of participants (eight out of nine individuals) also reported pain that may be more musculoskeletal in nature (i.e., "aching" or "stabbing" pain in one's back) or related to headache. These findings are consistent with previous MS research (e.g., Kalia & O'Connor, 2003; Osterberg et al., 2005).

Effects of CBT Treatment

Results from Study 1 showed small (but statistically nonsignificant) improvements on all of the outcome measures (pain severity, interference due to pain, affective distress) at post-treatment and at a three-month follow-up, as compared to the pre-treatment assessment, when data was examined in aggregate form. However, there was considerable variability in response to treatment when data was examined on an individual basis. Study 2 attempted to provide a more detailed analysis of the effectiveness of this CBT group program. Using a multiple baseline design across participants in Study 2, individual data was examined using visual inspection. Analyses of statistically and clinically significant changes supplemented visual inspection.

Pain severity.

In Study 2, contrary to the hypotheses made, there did not appear to be statistically or clinically significant changes on the measure of pain severity (with the

majority of participants reporting no change in this measure both during treatment and post-treatment phases as compared to the pre-treatment phase of study). These analyses were consistent with the results of the visual inspection of participants' graphs. Previous CBT research on pain management of chronic musculoskeletal pain (e.g., chronic low back pain) has consistently reported significant decreases in measures of pain severity as compared to control conditions, although previous research on pain management in rheumatoid arthritis has been more inconclusive regarding the effects of CBT on the same measure.

Consequently, it would appear that the results of Study 2 may be more consistent with the RA literature on CBT for pain management. This may be reflective of the fact that both diseases tend to be progressive in nature and consist of a number of problematic symptoms (persistent physical pain being just one of these symptoms). It is important to be mindful of the complex nature of MS when interpreting the present results. Lezak (1995) reported that individuals with MS typically experience a range of symptoms including difficulties with motor skills and mobility (prevalent in 80 - 90% of MS patients), fatigue (prevalent in 80 - 90% of MS patients), visual disturbances (prevalent in 65% of MS patients), cognitive difficulties (prevalent in 40 - 60% of MS patients), and affective disturbances. In fact, Forbes, While, Mathes, and Griffiths (2006) reported that 74% of their sample of MS patients reported experiencing four or more problems related to their MS in the course of a year. MS-related problems in this study included fatigue, depression, pain, employment difficulties, and relationship issues. Therefore, it is clear that pain represents just one of a multitude of symptoms MS patients typically encounter during the course of the disease. Forbes et al. (2006) also found that these MS-related

problems are not necessarily independent from one another. This complexity may have impacted the present results. As the current studies did not include measurements of general MS disease activity or specific MS-related symptoms such as fatigue, it is unclear if increased disease activity (i.e., increased symptomatology) may have accounted for the ineffectiveness of this CBT program in reducing reports of pain severity in Study 2. The degree to which these other MS symptoms may have impacted one's pain perceptions or one's ability to complete homework exercises between therapy sessions is unknown.

Interference in daily life activities due to pain.

In Study 2, contrary to the hypotheses made, many participants reported statistically and clinically significant increases in interference due to pain during the treatment and post-treatment phases of this study as compared to the baseline phase. These analyses are consistent with the results of the visual inspection of participants' graphs. Again, the degree to which other MS-related symptoms may have impacted participants' reported interference is unclear. For instance, measures of fatigue and motor disturbances were not included in this research but it might be assumed that during the course of the study participants may have been dealing with these two commonly reported MS symptoms. Although not formally assessed in this research, it was observed that in Study 2, 56% of participants used some type of assistive device for ambulation (i.e., cane, walker, or motorized wheelchair).

Similarly, it should be noted that in Study 2 seven of the nine participants were not working outside of the home, possibly suggestive of increased disease severity. This may be important in interpreting the unexpected increases in interference due to pain which were found as it is reasonable to assume that there would have been additional

physical demands placed on these seven individuals in attending a weekly group therapy session which they were not necessarily accustomed to. For instance, prior to taking part in this research study, if an unemployed individual was experiencing an increase in pain and/or MS symptoms on a particular day, they may be able to simply delay activities they might have planned for that day (e.g., housework or grocery shopping). However, while taking part in this research, this same individual now would have to attend a therapy session at a scheduled time each week, which would involve demands such as having to complete a number of self-care activities and arranging for transportation, all which would have to be completed by a certain time in order for he or she to attend the group session. Furthermore, he or she would then have to attend the group session and complete homework activities related to that session prior to attending the following week's meeting. It is hypothesized that the physical demands that this may have placed on individuals may have resulted in more interference in other daily life activities outside of the group sessions. In support of this hypothesis, it is noted that the only two participants (Participants 6 and 8) who exhibited significant (either statistically or clinically significant) decreases in interference during treatment were also the only two individuals who were working in part-time or full-time positions outside of home. These two participants may have been more likely to have had experience with having additional demands placed on them (due to their work experiences), therefore having more ability to cope with the demands of completing a CBT program.

Affective distress.

Results from Study 2 indicated that individuals taking part in this CBT group may have experienced some benefits in the area of affective distress following participation.

Although the visual inspection of participants' graphs suggested that the CBT program may not have been effective in decreasing reports of distress, statistically and clinically significant changes in phase means were found across several participants. However, the statistically and clinically significant decreases in distress which were observed did not tend to appear until during the post-treatment assessment phase of the study (i.e., in the month after the intervention program). Although it was hypothesized that significant decreases in distress would be observed during the treatment phase (as well as during the post-treatment phase), the results from this study may indicate that participants might require some cumulative time of skill acquisition before significant improvements are detected.

Social Support

A secondary purpose of Study 2 was to gather information about this group of pain patients' social support and to explore relationships between support and the three main outcome measures (pain severity, interference due to pain, and affective distress). Overall, individuals participating in Study 2 reported feeling well supported by their social network and the majority of individuals were satisfied with such support (and conversely reported very little disappointment with support). Interestingly, small decreases in perceived supportiveness were found when comparing assessments completed at pre-treatment, post-treatment, and three-month follow-up interviews. It is unclear as to what might have accounted for such slight decreases. As hypothesized, and consistent with previous research on social support in RA samples, the present study found that higher levels of perceived supportiveness were related to lower levels of pain

severity (assessed using a numeric rating scale), although there was only a low correlation between the variables.

In addition, there was a low negative correlation between support and affective distress in which higher levels of supportiveness were related to lower levels of distress. Although previous research using MS samples has found that there is no significant relationship between support and depression (e.g., Wineman, 1990), the current study measured general affective distress which included items assessing low mood as well as feelings of irritability and anxiety. This difference in measurement likely accounted for the different results.

Contrary to previous research with MS patients (and to the present study's hypotheses), this study found that there was a negative correlation (but nonsignificant) between perceived supportiveness and interference due to pain. The differences between these results and those reported by previous researchers (e.g., Ehde et al., 2003; Osborne et al., 2006) might be accounted for by several factors. Firstly, different measures of social support and interference due to pain were used in these studies. Secondly, differences in the characteristics of study samples might also make comparisons among studies challenging. For instance, Osborne et al.'s sample of MS patients consisted predominantly of men (86% of sample were men), while the present study's sample was made up of mostly women (67% of sample were women). Furthermore, Ehde et al. included a sample of MS patients recruited through the community, while most of the present sample was recruited through a MS clinic (67% of sample were recruited through the clinic).

The present study also included measures of satisfaction and disappointment with social support and explored their relationships with the main outcome variables. Although no previous research had been conducted examining the impact of satisfaction and disappointment with social support on measures of affective distress and interference due to pain, this research found that the more satisfied one was with social support, the less distress one reported, while the more disappointed one was with supports, the more distressed he or she tended to be. These findings were as expected. No relationship was found between disappointment with support and either measure of interference.

On the measure of interference, the results using the Interference subscale of the WHYMPI indicated that the more satisfied one was with supports, the more interference they also reported ($r = 0.5$). No relationship was found between the Pain Disability Index and satisfaction with support however ($r = 0.1$). The large difference in the correlation coefficient using the WHYMPI as compared to the PDI calls into question the validity of this result. Upon closer examination of the specific items of each of these two measures, it was observed that there are some differences between the measures which should be noted. In particular, the PDI includes measures of physical functioning related to daily life activities. Although the WHYMPI also includes this type of measure of physical functioning, it also includes items which assess participants' perceptions of how their pain problem has changed the satisfaction they get from family, work, or other social activities.

Lastly, both satisfaction with supports and disappointment with more of one's social support were found to be positively related to higher levels of pain severity. This finding may be explained by Holtzman et al.'s (2004) results which indicated that the

relationship between satisfaction and disappointment with supports and pain severity was influenced by the type of coping strategies utilized by individuals. Holtzman et al. found that satisfaction with support was associated with both maladaptive and adaptive coping strategies, which influenced pain severity, while disappointment with support was associated with maladaptive coping strategies. Extending these results to the present study, it might be possible that the positive relationships between satisfaction and disappointment with support and pain severity can be accounted for by an increased use of maladaptive coping strategies. Unfortunately, the present research did not include a measure of coping, therefore it is impossible to determine whether this hypothesis is correct.

Limitations and Future Directions

The current research is limited in that it studied a very small number of MS patients (including a total of 17 participants). The difficulties encountered in both of the present studies with respect to participant recruitment (which led to the small sample sizes) must be emphasized. Although there were a number of MS patients who expressed an interest in taking part in this research (but later declined), the barriers to participation which were routinely expressed were concerning transportation and the required time commitment. Transportation concerns have been reported by other authors working with MS samples (Ehde & Jensen, 2004). These issues must be addressed in future research. The use of traditional treatment delivery models (e.g., in person sessions) for patients who have a great deal of mobility issues may need to be reviewed. It may be helpful to examine the use of other methods of treatment delivery (such as phone or web-based sessions) which could reduce subject burden for these individuals.

This limited sample size also calls into question the generalizability of the present findings. Future research with larger sample sizes are needed to determine if these results would be characteristic for MS patients in general.

This research is also limited by the reliance on self-report measures which, although psychometrically reliable, may be influenced by factors such as treatment expectancies. Hadjistavropoulos and Craig (2002) indicate that self-report measures are particularly susceptible to response bias.

These studies also did not include a measure of MS disease severity (such as the Expanded Disability Status Scale by Kurtzke, 1983) which is typically used in descriptions of individuals with MS or measures of the prevalence of other MS-related symptoms such as fatigue and motor disturbances. Study 2 is also limited because it did not include an objective measure of cognitive functioning for those participants recruited through sources outside of the MS Clinic. Potential participants who self-identified as experiencing no major cognitive impairments excluded them from taking part in this research. Measurement of current cognitive functioning could have ensured that participants were not experiencing cognitive deficits which may have impacted their responses to treatment. Finally, this study did not control for the presence of other medical conditions which may also result in pain. Three participants in this study reported such conditions and it is unclear whether their reports of pain severity and interference due to pain may be based on all of their pain conditions, not just that which was MS-related.

Future research in this area could also benefit from including a comparison group. In Study 2, the use of a multiple baseline design across participants allowed for a

comparison of CBT with typical medical management for MS-related pain (i.e., management received during the baseline phase), however it is unclear from the present research whether the statistically and clinically significant improvements in affective distress which were observed were due to the CBT program or whether similar results would have been found if participants would have attended a more unstructured, supportive type of group program or other types of psychological interventions (i.e., behavioral treatment or biofeedback). If, in fact, CBT strategies are found to be more beneficial for MS patients as compared to other psychological interventions, it would be useful to know who might benefit most from such interventions and to determine if there are certain components of CBT which are more helpful to participants than others.

Conclusions

MS is a complex neurological condition. It is chronic and tends to be progressive in nature. The present intervention addressed only one of the multitude of issues faced by MS patients - persistent, physical pain. Although this research found that these CBT group sessions might not have been effective in decreasing self-reported pain severity and interference due to pain within this small group of individuals, these sessions were effective in decreasing psychological distress reported by several of these participants. Although future research is required to determine if these results may be generalized to other MS patients, this research is important in that it appears to be the first to focus solely on the use of a group CBT program for chronic pain management in a group of MS patients.

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Appendix A

Project Description and Consent Form – Study 1

Name of Project: Evaluating the Effects of Cognitive-Behavioral Group Treatment and Supportive Group Treatment for Chronic Pain Management in Individuals with Multiple Sclerosis

This consent form is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, please ask. Take the time to read this carefully and to understand any accompanying information. You will receive a copy of this form.

Background:

You are being asked to take part in a research project that will study what pain management interventions are helpful to individuals with Multiple Sclerosis (MS). The primary researchers are Ms. Jennifer Garinger (University of Manitoba), Dr. Michael Thomas (University of Manitoba), and Dr. Catherine Archibald (University of Calgary). This project has been approved by the University of Manitoba Psychology/Sociology Research Ethics Board, the Winnipeg Health Sciences Centre Research Impact Committee, and the University of Calgary Conjoint Health Research Ethics Board.

Pain has long been known to be one of the symptoms of Multiple Sclerosis. Although a number of pain management strategies have proven successful with other types of chronic pain conditions, very little research has been done examining the use the psychological strategies for MS-related pain. The purpose of this study is to assess the

effectiveness of psychological interventions for pain management for MS-related pain. These interventions will be described in more detail below.

By taking part in this study, you will have an opportunity to learn some strategies that may help you cope better with your pain. Both treatments being studied have been found to be of benefit to individuals suffering from chronic pain conditions, and it is expected that they will provide benefits to individuals with MS-related pain as well. If one of the treatments is found to provide more benefits than the other, all participants will be given the opportunity to receive that treatment.

You will also have a chance, in a group setting, to share your experiences relating to pain. Your involvement will help us to better understand what strategies are most effective for individuals with MS-related pain. It is expected that the information gained from this study will help other individuals with MS-related pain in the future.

If you agree to participate, you will be randomly assigned to either (a) cognitive-behavioral group treatment, (b) supportive group treatment, or (c) will be put on a waiting list and, if you choose, will receive treatment after approximately five months.

The cognitive-behavioral treatment involves paying attention to your thoughts (or cognitions) and behaviors relating to your pain. Sessions will include topics such as relaxation strategies, problem-solving skills, communication skills, learning to think more positively or realistically about situations, and learning how to slowly increase the amount of activity that you are able to engage in.

The supportive group treatment will involve sharing some of your experiences of pain with the other group members. Although the group may discuss any topic that is

important to you, some possible topics will include the effect that pain has had on your life and ways that you try to cope with your pain.

What is the purpose of the study?

The purpose of this study is to assess the effectiveness of psychological interventions for pain management for MS-related pain.

What would you have to do?

If you take part in this study, a research assistant will arrange several individual interview sessions with you, at different times, where information will be gathered about your health and related issues. In addition, you will take part in a series of 10 weekly sessions with a small group of up to 10 individuals, all with MS. As mentioned earlier, if you are assigned to the waiting list, you may have to wait up to 5 months to participate in these sessions. Your participation in this study will require your time and therefore will involve your commitment to attend meetings and practice strategies.

The individual interview sessions may each take between 1 and 2 hours to complete. These sessions will be completed three times: (a) at the beginning of the study, (b) after approximately 10 weeks, and (c) after approximately 3 months. These sessions will be arranged at your convenience.

The group sessions will take place over 10 consecutive weeks. Each session will last for 1 hour.

What are the risks?

There are no identified risks associated with the interventions being studied in this project. Although it is possible that discussing personal questions could result in some people feeling uncomfortable or stressed, it has been our experience, and that of other

researchers, that people don't mind these procedures. Nevertheless, you do not have to answer any question that you do not want to.

Will you benefit from taking part?

By taking part in this study, you will have an opportunity to learn some strategies that may help you cope better with your pain. Both treatments being studied have been found to be of benefit to individuals suffering from chronic pain conditions, and it is expected that they will provide benefits to individuals with MS-related pain as well. If one of the treatments is found to provide more benefits than the other, all participants will be given the opportunity to receive that treatment.

You will also have a chance, in a group setting, to share your experiences relating to pain. Your involvement will help us to better understand what strategies are most effective for individuals with MS-related pain. It is expected that the information gained from this study will help other individuals with MS-related pain in the future.

Although you may have to wait a period of time before participating in these group sessions (if you are assigned to a waiting list), you will be given the opportunity to receive the same treatment as other individuals, and therefore it is expected you will receive the same benefits.

Do you have to participate?

Taking part in this study is strictly voluntary. If you decide not to take part or if you decide to stop (which you may do at any time and for any reason), it will not affect any services you are getting now or could receive in the future.

Will you be paid for participating, or do you have to pay for anything?

If you agree to participate in this study, you will not get paid for attending sessions. However, there will be very little cost to you if you participate. Any books or materials that you may need will be provided to you at no cost. Additionally, each participant will be given $25 to help cover the costs of parking.

Will your records be kept private?

Any personal information you provide us will be strictly confidential. The information will be stored in a locked office and will be available only to personnel of this project. The identity of any individual will not be disclosed in any presentations or publications about the project. Only group information will be used in any presentations or publications about this project.

Although the group sessions you will participate in will involve discussing personal information with a small group of people, group members will be informed about the importance of keeping all group discussions confidential. This will allow group members to share important issues for them without worrying that members will discuss this with people outside of the group.

In addition, the group sessions that you take part in will be audiotaped and may be listened to by other individuals in your group program if they are unable to attend a session. As with all written information, all of the audiotapes will be stored in a locked office and will be available only to personnel of this project. Once the study has been completed, all tapes will be erased.

If you suffer a research-related injury, will you be compensated?

In the event that you suffer injury as a result of participating in this research, no compensation will be provided to you by the University of Manitoba, the Winnipeg

Health Sciences Centre, the University of Calgary, the Calgary Health Region or the Researchers. You still have all your legal rights. Nothing said in this consent form alters your right to seek damages.

Can you get a copy of this consent and the results of the study?

You can keep a copy of this consent form for your records. We will also be happy to send you information about the results of the study when it is completed if you contact the Ms. Jennifer Garinger by e-mail (umgaring@cc.umanitoba.ca) or by surface mail at the following address:

Ms. Jennifer Garinger

Department of Psychology, Duff Roblin Building

University of Manitoba

Winnipeg, MB

R3T 2N2

Signatures

Your signature on this form indicates that you have understood to your satisfaction the information regarding your participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without jeopardizing your health care. If you have further questions concerning matters related to this research, please contact:

<u>If You Participated in Winnipeg, MB:</u>

Ms. Jennifer Garinger (University of Manitoba), 474-9222, or

Dr. Michael Thomas (University of Manitoba), 474-9633,

Ms. Joanne Major (Winnipeg MS Clinic, Clinic Nurse Specialist), 787-2839, or

Ms. Margaret Bowman (Human Ethics Secretariat, University of Manitoba), 474-7122.

If You Participated in Calgary, AB:

Dr. Catherine Archibald (Foothills Hospital OPTIMUS Program, Psychologist), 944-4180, or

Dr. Luanne Metz (University of Calgary MS Clinic, Director), 670-4241.

In Calgary, if you have any questions concerning your rights as a possible participant in this research, please contact Pat Evans, Associate Director, Internal Awards, Research Services, University of Calgary, at 220-3782.

Participant's Name	**Signature and Date**
Investigator/Delegate's Name	**Signature and Date**
Witness' Name	**Signature and Date**

A signed copy of this consent form has been given to you to keep for your records and reference.

Appendix B

Demographic and Health Questionnaire

1. Date of Birth _____Day _____Month _____Year

2. Age _____ years

3. Sex Male_____ Female_____

4. Ethnicity White _____

African-Canadian _____

First Nations _____

East Indian _____

Asian _____

Hispanic _____

Other (please indicate)_____

5. Marital Status Single_____ Divorced_____

Married_____ Common Law _____

Separated_____ Other _____

6. Years in School (including secondary and post-secondary education)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

20+

7. Current Employment Full-time_____

Part-time_____

Unemployed_____

Student _____

On Disability _____

Retired _____

8. Date of MS Diagnosis _____

9. MS Subtype Relapse-Remitting _____

Secondary-Progressive _____

Primary-Progressive _____

Benign _____

Malignant _____

10. Other Medical Conditions, Current and Past? If so, please list below:

_____

_____

_____

_____

11. CURRENT Medications and Dosages (please indicate if any of these medications have been prescribed for pain relief). Please all medications you take, whether or not they have been prescribed by a physician.

_____

_____

_____

_____

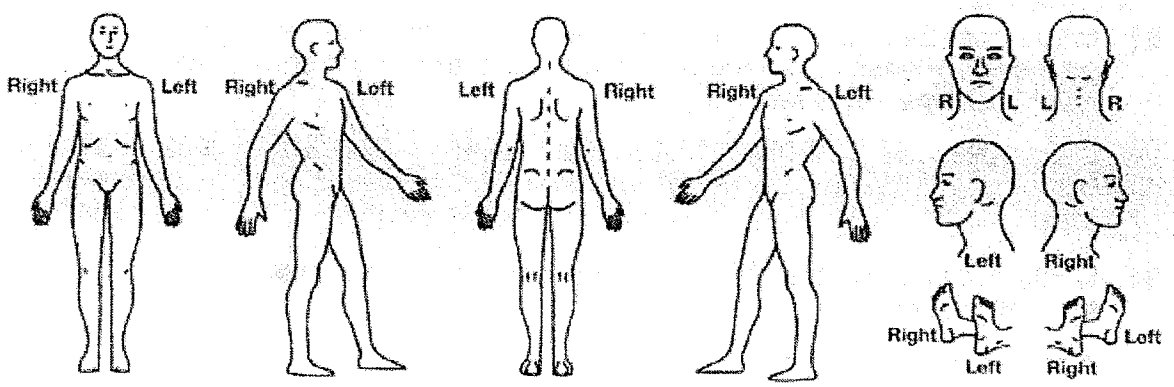
_____

Appendix C

Pain Assessment Tool

A.

I. **Location:** Participant or researcher marks drawing



II. **Intensity:** Participant rates the pain for each site indicated above.

Present:_____

Worst pain gets:_____

Best pain gets:_____

Acceptable level of pain:_____

Rating Scale:

0	No Pain
1	Mild
2	Discomforting
3	Distressing
4	Horrible
5	Excruciating

III. **Quality:** (Use participant's own words, e.g., prick, ache, burn, throb, pull, sharp). Indicate for each site in I.

_____

IV. **Onset, duration, variations, rhythms:**

_____

V. **Manner of expressing pain:**

_____

VI. **What relieves the pain?**

_____

VII. **What causes or increases the pain?**

_____

VIII. **Effects of pain:** (Note decreased function, decreased quality of life.)

Accompanying symptoms (e.g., nausea)_____

Sleep_____

Appetite_____

Physical activity_____

Relationship with others (e.g., irritability)_____

Emotions (e.g., anger, suicidal, crying)_____

Concentration_____

Other_____

IX. **Other comments:**_____

B.

1) Please rate your pain by circling the one number that best describes your pain at its **WORST** in the past 24 hours.

_____

0 1 2 3 4 5 6 7 8 9 10

No pain — Pain as bad as you can imagine

2) Please rate your pain by circling the one number that best describes your pain at its **LEAST** in the past 24 hours.

_____

0 1 2 3 4 5 6 7 8 9 10

No Pain as bad as

pain you can imagine

3) Please rate your pain by circling the one number that best describes your pain on the **AVERAGE**.

---

0 1 2 3 4 5 6 7 8 9 10

No Pain as bad as

pain you can imagine

4) Please rate your pain by circling the one number that tells how much pain you have **RIGHT NOW**.

---

0 1 2 3 4 5 6 7 8 9 10

No Pain as bad as

pain you can imagine

5) What treatments or medications are you receiving for your pain?

---

6) In the past 24 hours, how much **RELIEF** have pain treatments or medications provided? Please circle the one percentage that most shows how much.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

No Complete

relief relief

7) Circle the one number that describes how, during the past 24 hours, **PAIN HAS INTERFERED** with your:

A. General Activity:

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

B. Mood

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

C. Walking ability

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

D. Normal work (includes both work outside the home and housework)

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

E. Relations with other people

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

F. Sleep

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

G. Enjoyment of life

---

0 1 2 3 4 5 6 7 8 9 10

Does not Completely

interfere interferes

Appendix D

The West Haven-Yale Multidimensional Pain Inventory

Answer the following questions to describe your pain and how it affects your life. Please circle a number on the scale under that question to indicate how that specific question applies to you. A significant other could be a spouse, boyfriend/girlfriend, a family member, or a friend.

Please circle your relationship to the person you will be rating in these questions as your significant other.

1. spouse
2. boyfriend who you have been dating for at least six months
3. girlfriend who you have been dating for at least six months
4. mother
5. father
6. sibling
7. friend

1. Rate the level of your pain at the present moment.

1 2 3 4 5 6 7

No Pain Very Intense Pain

2. In general, how much does your pain problem interfere with your day to day activities?

1 2 3 4 5 6 7

No Interference Extreme Interference

3. Since the time you developed a pain problem, how much has your pain changed your ability to work?

1 2 3 4 5 6 7

No Change Extreme Change

_____ Check here if you have retired for reasons other than your pain problem.

4. How much has your pain changed the amount of satisfaction or enjoyment you get from participating in social and recreational activities?

1 2 3 4 5 6 7

No Change Extreme Change

5. How supportive or helpful is your significant other to you in relation to your pain?

1 2 3 4 5 6 7

Not At All Supportive Extremely Supportive

6. Rate your overall mood during the past week.

1 2 3 4 5 6 7

Extremely Low Mood Extremely High Mood

7. On the average, how severe has your pain been during the last week?

1 2 3 4 5 6 7

Not At All Severe Extremely Severe

8. How much has your pain changed your ability to participate in recreational and other social activities?

1 2 3 4 5 6 7

No Change Extreme Change

9. How much has your pain changed the amount of satisfaction you get from family-related activities?

1 2 3 4 5 6 7

No Change Extreme Change

10. How worried is your significant other about you in relation to your pain problem?

1 2 3 4 5 6 7

Not At All Worried Extremely Worried

11. During the past week, how much control do you feel you have had over your life?

1 2 3 4 5 6 7

Not At All In Control Extremely In Control

12. How much suffering do you experience because of your pain?

1 2 3 4 5 6 7

No Suffering Extreme Suffering

13. How much has your pain changed your marriage or family relationships?

1 2 3 4 5 6 7

No Change Extreme Change

14. How much has your pain changed the amount of satisfaction and enjoyment you get from work?

1 2 3 4 5 6 7

No Change Extreme Change

_____ Check here if you are not presently working.

15. How attentive is your significant other to your pain problem?

1 2 3 4 5 6 7

Not At All Attentive Extremely Attentive

16. During the past week, how much do you feel that you've been able to deal with your problems?

1 2 3 4 5 6 7

Not At All Extremely Well

17. How much has your pain changed your ability to do household chores?

1 2 3 4 5 6 7

No Change Extreme Change

18. During the past week, how irritable have you been?

1 2 3 4 5 6 7

Not At All Irritable Extremely Irritable

19. How much has your pain changed your friendships with people other than your family?

1 2 3 4 5 6 7

No Change Extreme Change

20. During the past week, how tense or anxious have you been?

1 2 3 4 5 6 7

Not At All Tense or Anxious — Extremely Tense or Anxious

Appendix E

The Symptom Checklist 90 – Revised

Instructions: Below is a list of problems and complaints that people sometimes have. Please read each one carefully. After you have done so, please circle one of the numbers to the right that best describes **how much discomfort that problem has caused you during the past week, including today.** Circle only one number for each problem and do not skip any items.

	Not At All	A Little Bit	Moderately	Quite A Bit	Extremely
How much were you distressed by:					
1. Headaches	0	1	2	3	4
2. Nervousness or shakiness inside	0	1	2	3	4
3. Repeated unpleasant thoughts that won't leave your mind	0	1	2	3	4
4. Faintness or dizziness	0	1	2	3	4
5. Loss of sexual interest or pleasure	0	1	2	3	4
6. Feeling critical of others	0	1	2	3	4
7. The idea that someone else can control your thoughts	0	1	2	3	4
8. Feeling that others are to blame for your problems	0	1	2	3	4
9. Trouble remembering things	0	1	2	3	4
10. Worried about sloppiness or carelessness	0	1	2	3	4

11. Feeling easily annoyed or irritated	0	1	2	3	4
12. Pains in heart or chest	0	1	2	3	4
13. Feeling afraid in open spaces or on the streets	0	1	2	3	4
14. Feeling low in energy or slowed down	0	1	2	3	4
15. Thoughts of ending your life	0	1	2	3	4
16. Hearing voices that other people do not hear	0	1	2	3	4
17. Trembling	0	1	2	3	4
18. Feeling that most people cannot be trusted	0	1	2	3	4
19. Poor appetite	0	1	2	3	4
20. Crying easily	0	1	2	3	4
21. Feeling shy or uneasy with the opposite sex	0	1	2	3	4
22. Feelings of being trapped or caught	0	1	2	3	4
23. Suddenly scared for no reason	0	1	2	3	4
24. Temper outbursts that you could not control	0	1	2	3	4
25. Feeling afraid to go out of your	0	1	2	3	4

house alone					
26. Blaming yourself for things	0	1	2	3	4
27. Pains in lower back	0	1	2	3	4
28. Feeling blocked in getting things done	0	1	2	3	4
29. Feeling lonely	0	1	2	3	4
30. Feeling blue	0	1	2	3	4
31. Worrying too much about things	0	1	2	3	4
32. Feeling no interest in things	0	1	2	3	4
33. Feeling fearful	0	1	2	3	4
34. Your feelings being easily hurt	0	1	2	3	4
35. Other people being aware of your private thoughts	0	1	2	3	4
36. Feeling others do not understand you or are unsympathetic	0	1	2	3	4
37. Feeling that people are unfriendly or dislike you	0	1	2	3	4
38. Having to do things very slowly to ensure correctness	0	1	2	3	4
39. Heart pounding or racing	0	1	2	3	4
40. Nausea or upset stomach	0	1	2	3	4
41. Feeling inferior to others	0	1	2	3	4
42. Soreness of your muscles	0	1	2	3	4

43. Feeling that you are watched or talked about by others	0	1	2	3	4
44. Trouble falling asleep	0	1	2	3	4
45. Having to check and double-check what you do	0	1	2	3	4
46. Difficulty making decisions	0	1	2	3	4
47. Feeling afraid to travel on buses, subways, or trains	0	1	2	3	4
48. Trouble getting your breath	0	1	2	3	4
49. Hot or cold spells	0	1	2	3	4
50. Having to avoid certain things, places, or activities because they frighten you	0	1	2	3	4
51. Your mind going blank	0	1	2	3	4
52. Numbness or tingling in parts of your body	0	1	2	3	4
53. A lump in your throat	0	1	2	3	4
54. Feeling hopeless about the future	0	1	2	3	4
55. Trouble concentrating	0	1	2	3	4
56. Feeling weak in parts of your body	0	1	2	3	4
57. Feeling tense or keyed up	0	1	2	3	4
58. Heavy feelings in your arms or legs	0	1	2	3	4

59. Thoughts of death or dying	0	1	2	3	4
60. Overeating	0	1	2	3	4
61. Feeling uneasy when people are watching or talking about you	0	1	2	3	4
62. Having thoughts that are not your own	0	1	2	3	4
63. Having urges to beat, injure, or harm someone	0	1	2	3	4
64. Awakening in the early morning	0	1	2	3	4
65. Having to repeat the same actions such as touching, counting, or washing	0	1	2	3	4
66. Sleep that is restless or disturbed	0	1	2	3	4
67. Having urges to break or smash things	0	1	2	3	4
68. Having ideas or beliefs that others do not share	0	1	2	3	4
69. Feeling very self-conscious with others	0	1	2	3	4
70. Feeling uneasy in crowds, such as shopping or at a movie	0	1	2	3	4
71. Feeling everything is an effort	0	1	2	3	4
72. Spells of terror or panic	0	1	2	3	4
73. Feeling uncomfortable about	0	1	2	3	4

eating or drinking in public					
74. Getting into frequent arguments	0	1	2	3	4
75. Feeling nervous when you are left alone	0	1	2	3	4
76. Others not giving you proper credit for your achievements	0	1	2	3	4
77. Feeling lonely even when you are with people	0	1	2	3	4
78. Feeling so restless you couldn't sit still	0	1	2	3	4
79. Feelings of worthlessness	0	1	2	3	4
80. The feeling that something bad is going to happen to you	0	1	2	3	4
81. Shouting or throwing things	0	1	2	3	4
82. Feeling afraid that you will faint in public	0	1	2	3	4
83. Feeling that people will take advantage of you if you let them	0	1	2	3	4
84. Having thoughts about sex that bother you a lot	0	1	2	3	4
85. The idea that you should be punished for your sins	0	1	2	3	4
86. Thoughts and images of a	0	1	2	3	4

frightening nature					
87. The idea that something is seriously wrong with your body	0	1	2	3	4
88. Never feeling close to another person	0	1	2	3	4
89. Feelings of guilt	0	1	2	3	4
90. The idea that something is wrong with your mind	0	1	2	3	4

Appendix F

Pain Disability Index

The rating scales below are designed to measure the degree to which several aspects of your life are presently disrupted by chronic pain. In other words, we would like to know how much your pain is preventing you from doing what you would normally do, or from doing it as well as you normally would. Respond to each category by indicating the overall impact of pain in your life, not just when the pain is at its worst. For each of the 7 categories of life activity listed, please circle the number on the scale which describes the level of disability you typically experience. A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain.

1. FAMILY/HOME RESPONSIBILITIES

This category refers to activities related to the home or family. It includes chores or duties performed around the house (e.g., yard work) and errands or favors for other family members (e.g., driving the children to school).

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

2. RECREATION

This category includes hobbies, sports, and other similar leisure time activities.

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

3. SOCIAL ACTIVITY

This category refers to activities which involve participation with friends and acquaintances other than family members. It includes parties, theatre, concerts, dining out, and other social functions.

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

4. OCCUPATION

This category refers to activities that are part of or directly related to one's job. This includes non-paying jobs as well, such as that of a housewife or volunteer worker.

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

5. SEXUAL BEHAVIOR

This category refers to the frequency and quality of one's sex life.

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

6. SELF-CARE

This category includes activities which involve personal maintenance and independent daily living (e.g., taking a shower, driving, getting dressed, etc.).

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

7. LIFE-SUPPORT ACTIVITY

This category refers to basic life-supporting behaviors such as eating, sleeping, and breathing.

0 1 2 3 4 5 6 7 8 9 10

NO TOTAL

DISABILITY DISABILITY

Appendix G

Session Agendas for Cognitive-Behavioral Treatment Group (adapted from Caudill, 2002)

Note: The scripts included in this outline are not intended to be read verbatim. They are intended, rather, as guides to the information that will be presented in the group sessions.

Session 1

1. Welcoming of participants and outline of group session.

2. Introduction of participants. Each group member is asked to briefly introduce themself to the other members.

3. Overview of "group rules" (e.g., confidentiality, relationships with group members).

4. Completion of questionnaire on medication use.

5. Overview of purpose and approach of this program.

6. Overview of program outline, including skills that will be taught, procedures that will be used, and participants' responsibilities. The structure of the workbook, "Managing Your Pain Before It Manages You", will be reviewed.

7. Discussion Questions:

    a. Individuals' experiences with groups: Has anyone had any experience with groups before? What was that experience like for you?
    b. Individuals' experiences with pain: How long have you suffered from pain? Where is your pain? What have you tried to do to manage your pain?

8. Treatment credibility rating form. The participants will be assisted in completing the pre-treatment version of this form.

9. Review and homework assignment. The information discussed in the session will be reviewed and participants will be given another opportunity to ask any questions. Homework: Read chapter 1 in "Managing Your Pain Before It Manages You" and complete pain diary and goal-setting exercise.

10. Feedback from participants.

11. Complete reliability checklists.

Session 2

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review of homework assignment. Determine if there are any patterns in pain apparent from the pain diaries. Go over each individual's goals relating to pain.

4. Reconceptualization of pain using the gate-control model. The goal of the reconceptualization phase is to provide the participants with a pain conceptualization that will facilitate therapy and make its rationale understandable. A simplified version of Melzack and Wall's (1965, 1970) gate-control theory will be presented as a conceptual model of pain (adapted from Karol, Doerfler, Parker, & Armentrout, 1981):

I am going to present to you a simple theory for understanding pain and the factors that affect it. Pain can begin with bodily damage or injury, or with disease. A pain message from the site of injury is sent through a mechanism that works like a "gate to the brain". The brain then interprets this message. This gate can be partially or fully opened, or closed, which determines the amount of pain. There are many factors that can influence how much the "pain gate" is open. These factors generally fall into three categories: physical factors, emotional factors, and mental factors.

The gate-control model will be presented visually on a flip-chart to assist the participants in understanding and adopting this conceptualization. The following list of pain-influencing factors will be discussed, with specific personal examples being sought from group members:

- Factors that open the gate:
    1. Physical factors
        a. Extent of the injury
        b. Readiness of the nervous system to send pain signals to the brain
        c. Inappropriate activity level
    2. Emotional stress
        a. Depression
        b. Anxiety
        c. Worry
        d. Tension
        e. Anger
    3. Mental factors
        a. Focusing attention on the pain
        b. Boredom due to minimal involvement in life activities
        c. Nonadaptive attitudes
- Factors that close the gate:
    1. Physical factors

a. Medication

b. Counterstimulation (heat, massage, acupuncture, transcutaneous neural stimulation (TENS))

c. Appropriate activity level

2. Relative emotional stability

a. Relaxation

b. Positive emotions (e.g., happiness, optimism)

c. Rest

3. Mental factors

a. Life involvement and increased interest in life activities

b. Concentration on other things (distraction)

c. Adaptive attitudes

- Participants will be asked to discuss examples of pain situations (possibly from their pain diaries), examining how factors in each of these categories affected their pain experience.

5. Review and homework assignment. Homework this week will be to read Chapter 2 in "Managing Your Pain Before It Manages You" and to complete all of the questions throughout this chapter (e.g., medication use, exploring the meaning of pain). As well, participants will continue to keep a pain diary.

6. Feedback from participants.

7. Complete reliability checklists.

Session 3

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review of homework assignment.

4. Introduce relaxation training. The first step in introducing a treatment technique is to provide a rationale for its use. The discussion of relaxation will include:

How relaxation can be explained within the gate-control model of pain. Pain is affected negatively (gate opened) by tension, anxiety, worry, and inappropriate activity levels. Pain is positively affected (gate closed) by emotional stability, relaxation, appropriate activity levels, etc.

Different strategies/activities help different people to relax. Participants are asked when and how they have experienced relaxation. This discussion will be summarized by informing participants that although we all probably know some ways of relaxing, we can usually learn to relax better (deeper, easier, in more situations, etc.). Relaxation is a LEARNED SKILL.

- Why relaxation helps to decrease pain?
    1. Muscle tension increases pain sensations.
    2. Concentrating on relaxation takes attention away from pain.
    3. Relaxation reduces the likelihood of feeling anxious or depressed – emotions that increase pain.
    4. It helps you to become more aware of tension in different parts of your body.

5. It can help you to sleep better. Feeling tired tends to increase pain.

There are many different types of relaxation techniques. We will be discussing one:

- Diaphragmatic breathing – the group will practice this in-session
  - using a focus word or phrase on out-breath
  - incorporating breathing and imagination
  - incorporating breathing and progressive muscle relaxation
  - repetitive motion

5. Review and homework assignments. Homework this week will be to read Chapter 3 and complete all of the "Exploration Tasks" beginning on page 58. Review how to complete the Relaxation Response Technique Diary and instruct participants to complete over the week. Participants will also continue to keep pain diaries.

6. Feedback from participants.

7. Complete reliability checklists.

Session 4

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review of homework assignment. Review pain diaries, practice of relaxation techniques, focusing on problem solving. Diaphragmatic breathing will be practiced again in-session.

4. Introduce pain management strategies of:

- Pacing – Participants will learn the importance of pacing oneself and not "overdoing" activities. Stress the importance of determining how much of an activity you can complete without experiencing a significant increase in pain.
- Adaptation - Participants will be encouraged to think of ways to change activities so that they do not cause as much pain and discomfort.
- Delegation of activities to others

5. Becoming more aware of bodily sensations (p. 69 – 72): As mentioned in the workbook, as a person becomes more aware of his or her body's messages, it is easier to avoid engaging in activities that may increase pain. In the session, participants will be led through the exercise focusing on labeling sensations in one's arms.

6. Review and homework assignments. Homework for this week will be to read Chapter 4 in the workbook and complete the "Exploration Tasks" on pages 78 – 80, as well as continuing the pain diaries and relaxation practice.

7. Feedback from participants.

8. Complete reliability checklists.

Session 5

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review of homework assignment. Review pain diaries, practice of relaxation techniques, and progress on increasing activities.

4. Introduce cognitive restructuring. This phase of the program will focus on how the participants can influence their pain experiences by altering their interpretations of the sensations. Several steps in the process of cognitive restructuring will be discussed:

- Automatic thoughts, or self-talk.
    - Types of cognitive distortions (review the 10 distortions on page 87 and have participants give examples of negative thoughts that they've had that fall into these categories)
- Changing negative thoughts (Have each participant give an example of a negative thought and how they can change this thought.)
    - Challenging thoughts (how realistic are my thoughts?)
    - Clarifying the problem and determine what you can do
    - Preparing for the worst (the vertical arrow technique)

5. Review and homework assignments. Homework for this week will be to read Chapter 5 in the workbook and complete questions 1, 2, 3, and 6 in the "Exploration Tasks". In addition, participants will continue to complete pain diaries and practice relaxation.

6. Feedback from participants.

7. Complete reliability checklists.

Session 6

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review homework assignments, focusing on "Daily Record of Automatic Thoughts".

4. Common problematic attitudes (pages 111 – 115)

- Learned helplessness
- Anger

Have participants experienced some of these attitudes? Have participants give examples from their own experience.

5. Healthy attitudes (pages 115 – 120)

- Stress Hardiness, optimism, empathy, altruism
- Developing healthy attitudes through affirmations, self-esteem, humor

6. Review and homework assignments. Homework for this week will be to read Chapter 6 in the workbook and complete all of the questions in the "Exploration Tasks" on page 121.

7. Feedback from participants.

8. Complete reliability checklists.

Session 7

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review homework.

4. Nutrition's influence on pain

- When to eat (page 129)
- What to eat (page 130)
- Caffeine, alcohol intake
- Discuss how much caffeine/alcohol participants are consuming. If needed, encourage individuals to decrease consumption.

5. Review and homework assignments. Homework for this week will be to read Chapter 7 in the workbook and complete all of the questions in the "Exploration Tasks" on page 135.

6. Feedback from participants.

7. Complete reliability checklists.

Session 8

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review homework.

4. Developing more effective communication skills.

- Learning to communicate better with health professionals (pages 140 – 142)

  Have participants had difficulty communicating their concerns or questions to health professionals?

- Practicing assertiveness

  Is this an area that individuals have trouble with? Discuss differences between being assertive, passive, or aggressive in communications with others. How can individuals practice being more assertive in their daily life?

- Active listening skills

5. Review and homework assignments. Homework for this week will be to read Chapter 8 in the workbook and complete all of the questions in the "Exploration Tasks" on page 149.

6. Feedback from participants.

7. Complete reliability checklists.

Session 9

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review homework.

4. Identifying barriers to accomplishing your goals (page 158)

- What steps do you need to take in order to get back on track with working towards your goals? (page 159)

5. Ways of coping with problems

- Physical, emotional, and problem-focused ways of coping (pages 160 – 162)

6. Review and homework assignments. Homework for this week will be to read Chapter 9 in the workbook and complete all of the questions in the "Exploration Tasks" on page 163 – 165).

7. Feedback from participants.

8. Complete reliability checklists.

Session 10

1. Outline of session.

2. Completion of questionnaires on medication use and homework completion.

3. Review homework.

4. Preparing for post-treatment

- Issues relating to the maintenance of knowledge and skills will be discussed. The importance of regular rehearsal of skills will be emphasized.
    - Relapse prevention: Participants will think of situations that may prevent them from continuing to use the skills that they have been practicing over the past several weeks and ways to overcome these problems (p. 168 in workbook).
    - Coping with flare-ups in pain: Each participant will develop a plan for daily pain management, mild to moderate pain increases, and severe pain increases (p. 170 in workbook).

5. Review of group program. Do participants have any questions, concerns, or ideas?

6. Termination of group. Participants will be informed of individual sessions that will take place for assessment (post-treatment and follow-up).

7. Feedback from participants.

8. Complete reliability checklists.

Appendix H

Questionnaire on Medication Use

Today's Date: _____

Please complete the following questions about medications that you may have taken in the past 24 hours.

1. Did you take any type of medication in the past 24 hours?

_____ YES _____ NO

If YES, please complete the following information for each medication you took:

a. Name of Medication: _____

Time Last Taken: _____

Dose Taken at Above Time: _____

b. Name of Medication: _____

Time Last Taken: _____

Dose Taken at Above Time: _____

c. Name of Medication: _____

Time Last Taken: _____

Dose Taken at Above Time: _____

d. Name of Medication: _____

Time Last Taken: _____

Dose Taken at Above Time: _____

e. Name of Medication: _____

Time Last Taken: _____

Dose Taken at Above Time: _____

Appendix I

Rating of Work Completed Between Sessions – Study 1

Today's Date: _____

From the options below, please indicate how many hours you spent **in the past week** completing any work relating to this group:

_____ 0 - 2 hours

_____ 2 - 4 hours

_____ 4 - 6 hours

_____ 6 - 8 hours

_____ 8 - 10 hours

_____ over 10 hours

Appendix J

Treatment Integrity Ratings

The accompanying audiotape contains a series of randomly selected 5-minute segments from group therapy sessions. These sessions were part of a pain management program for individuals with multiple sclerosis.

The pain program consisted of a **cognitive-behavioral group therapy**. This treatment was based on a standard cognitive-behavioral pain management program. Components of the treatment included understanding pain, learning relaxation techniques, increasing activities, cognitive restructuring, problem-solving, communication skills, nutrition, and relapse prevention. Participants were asked to complete weekly homework assignments to enhance development of pain coping skills. The general format of each session was (a) review of previously discussed material and homework assignments, (b) presentation and practice of new information and skills, and (c) review of the session and assignments for homework.

Instructions: For each 5-minute segment, please listen to the therapist's statements and indicate below what you believe the focus or topic of this particular session was.

Segment Number	**Topic of Session**
1	_____
2	_____
3	_____
4	_____
5	_____

Segment Number	Topic of Session
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	

Appendix K

Treatment Credibility Rating Form To Be Completed After The First Treatment Session

Instructions: Based on the information that has been provided to you regarding the pain management program, please provide your impression in the following areas:

1. How logical does this type of program seem to you?

1 2 3 4 5 6 7 8 9 10

not at all logical very logical

2. How confident are you that this program will be successful in helping you to cope with your pain?

1 2 3 4 5 6 7 8 9 10

not at all confident very confident

3. How confident would you be in recommending this program to a friend who was experiencing pain?

1 2 3 4 5 6 7 8 9 10

not at all confident very confident

4. How interested are you in continuing with this program?

1 2 3 4 5 6 7 8 9 10

not at all interested very interested

5. Do you think that this type of program would be successful for helping people with other types of health problems?

1 2 3 4 5 6 7 8 9 10

not at all successful very successful

Appendix L

Treatment Credibility Rating Form To Be Completed In Last Group Session

Instructions: Based on the information that has been provided to you regarding the pain management program, please provide your impression in the following areas:

1. How logical did this type of program seem to you?

1 2 3 4 5 6 7 8 9 10

not at all logical very logical

2. How confident are you that this program has been successful in helping you to cope with your pain?

1 2 3 4 5 6 7 8 9 10

not at all confident very confident

3. How confident would you be in recommending this program to a friend who was experiencing pain?

1 2 3 4 5 6 7 8 9 10

not at all confident very confident

4. How satisfied are you that you took part in the program?

1 2 3 4 5 6 7 8 9 10

not at all satisfied very satisfied

5. Do you think that this type of program would be successful for helping people with other types of health problems?

1 2 3 4 5 6 7 8 9 10

not at all successful very successful

Appendix M

Procedural Reliability Checklist for Cognitive-Behavioral Group Treatment Program - Therapist Completed

Session 1:

_____ Welcomed group members and presented outline of session.

_____ Completed introductions.

_____ Overviewed group rules.

_____ Group members completed questionnaire on medication use.

_____ Overviewed the purpose and general approach of the program.

_____ Briefly outlined program.

_____ Discussion of group members' previous group experiences.

_____ Discussion of group members' personal experiences with pain.

_____ Group members completed treatment credibility rating form.

_____ Session (information/discussions) reviewed.

_____ Homework assignment presented and discussed: Chapter 1 in book.

_____ General feedback sought from group members.

Session 2:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: program overview, group experiences, pain experiences.

_____ Reviewed homework assignment: pain diaries, goals.

_____ Group members completed homework checklist.

_____ Introduced gate-control model as a theory for understanding pain.

_____ Sought personal examples from group members for each of the factors.

_____ Examined group members' pain experiences in terms of how factors in each category affected these experiences.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 2 in book.

_____ General feedback sought from group members.

Session 3:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: factors influencing pain, gate-control model of pain.

_____ Reviewed homework assignment: pain diaries, medication use.

_____ Group members completed homework checklist.

_____ Discussed relaxation training: rationale and why it works.

_____ Introduced one relaxation technique and practiced in-session: diaphragmatic breathing.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 3 in book.

_____ General feedback sought from group members.

Session 4:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: relaxation training.

_____ Reviewed homework assignment: pain diaries, relaxation practice.

_____ Group members completed homework checklist.

_____ In-session practice of diaphragmatic breathing. Followed by discussion and problem-solving.

_____ Introduction of pain coping strategies (pacing, adaptation, delegation).

_____ Discussion of importance of being aware of bodily sensations. Followed by example of labeling sensations in one's arms.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 4 in book.

_____ General feedback sought from group members.

Session 5:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: pacing, adaptation, delegation, bodily awareness.

_____ Reviewed homework assignment: pain diaries, relaxation practice, increasing activities.

_____ Group members completed homework checklist.

_____ Introduced rationale for cognitive restructuring.

_____ Group discussion on identifying automatic thoughts and cognitive distortions.

_____ Group discussion on strategies for changing negative thinking (challenging thoughts, problem-solving, preparing for the worst).

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 5 in book.

_____ General feedback sought from group members.

Session 6:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: cognitive restructuring.

_____ Reviewed homework assignment: pain diaries, relaxation practice, daily record of automatic thoughts, questions on anger.

_____ Group members completed homework checklist.

_____ Group discussion of problematic attitudes: learned helplessness, anger.

_____ Group discussion of healthy attitudes & ways to develop these attitudes.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 6 in book.

_____ General feedback sought from group members.

Session 7:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: problematic & healthy attitudes.

_____ Reviewed homework assignment: relaxation practice, changing negative thoughts, developing more healthy attitudes.

_____ Group members completed homework checklist.

_____ Group discussion on nutrition and its influence on pain, emphasizing caffeine & alcohol use.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 7 in book.

_____ General feedback sought from group members.

Session 8:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: nutrition.

_____ Reviewed homework assignment: food diary.

_____ Group members completed homework checklist.

_____ Introduced effective communication skills: communicating with health professionals, assertiveness, active listening.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 8 in book.

_____ General feedback sought from group members.

Session 9:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: communication skills.

_____ Reviewed homework assignment: assertive communication, listening and assertive responses.

_____ Group members completed homework checklist.

_____ Discussion of barriers to accomplishing goals.

_____ Discussion of ways of coping with problems (problem-solving).

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 9 in book.

_____ General feedback sought from group members.

Session 10:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: problem-solving.

_____ Reviewed homework assignment: barriers to accomplishing goals.

_____ Group members completed homework checklist.

_____ Emphasized importance of regular rehearsal of skills.

_____ Discussion of resources available to assist with pain coping and/or difficulties that arise.

_____ Discussion of coping with flare-ups (planning for relapses), emphasizing daily management strategies, strategies for mild-moderate increases in pain, and strategies for severe pain increases.

_____ General review and discussion of program. Group members encouraged to raise questions, concerns, or ideas.

_____ Group members informed of individual sessions for assessment (post-treatment and follow-up). Sessions scheduled.

_____ General feedback sought from group members.

Appendix N

Procedural Reliability Checklist for Cognitive-Behavioral Group Treatment Program - Participant Completed

Please complete the following checklist before you leave today's group session. Beside each item, place a checkmark if you feel that the therapist completed this step in the program.

Session 1:

_____ Welcomed group members and presented outline of session.

_____ Completed introductions.

_____ Overviewed group rules.

_____ Group members completed questionnaire on medication use.

_____ Overviewed the purpose and general approach of the program.

_____ Briefly outlined program.

_____ Discussion of group members' previous group experiences.

_____ Discussion of group members' personal experiences with pain.

_____ Group members completed treatment credibility rating form.

_____ Session (information/discussions) reviewed.

_____ Homework assignment presented and discussed: Chapter 1 in book.

_____ General feedback sought from group members.

Session 2:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: program overview, group experiences, pain experiences.

_____ Reviewed homework assignment: pain diaries, goals.

_____ Group members completed homework checklist.

_____ Introduced gate-control model as a theory for understanding pain.

_____ Sought personal examples from group members for each of the factors.

_____ Examined group members' pain experiences in terms of how factors in each category affected these experiences.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 2 in book.

_____ General feedback sought from group members.

Session 3:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: factors influencing pain, gate-control model of pain.

_____ Reviewed homework assignment: pain diaries, medication use.

_____ Group members completed homework checklist.

_____ Discussed relaxation training: rationale and why it works.

_____ Introduced one relaxation technique and practiced in-session: diaphragmatic breathing.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 3 in book.

_____ General feedback sought from group members.

Session 4:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: relaxation training.

_____ Reviewed homework assignment: pain diaries, relaxation practice.

_____ Group members completed homework checklist.

_____ In-session practice of diaphragmatic breathing. Followed by discussion and problem-solving.

_____ Introduction of pain coping strategies (pacing, adaptation, delegation).

_____ Discussion of importance of being aware of bodily sensations. Followed by example of labeling sensations in one's arms.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 4 in book.

_____ General feedback sought from group members.

Session 5:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: pacing, adaptation, delegation, bodily awareness.

_____ Reviewed homework assignment: pain diaries, relaxation practice, increasing activities.

_____ Group members completed homework checklist.

_____ Introduced rationale for cognitive restructuring.

_____ Group discussion on identifying automatic thoughts and cognitive distortions.

_____ Group discussion on strategies for changing negative thinking (challenging thoughts, problem-solving, preparing for the worst).

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 5 in book.

_____ General feedback sought from group members.

Session 6:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: cognitive restructuring.

_____ Reviewed homework assignment: pain diaries, relaxation practice, daily record of automatic thoughts, questions on anger.

_____ Group members completed homework checklist.

_____ Group discussion of problematic attitudes: learned helplessness, anger.

_____ Group discussion of healthy attitudes & ways to develop these attitudes.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 6 in book.

_____ General feedback sought from group members.

Session 7:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: problematic & healthy attitudes.

_____ Reviewed homework assignment: relaxation practice, changing negative thoughts, developing more healthy attitudes.

_____ Group members completed homework checklist.

_____ Group discussion on nutrition and its influence on pain, emphasizing caffeine & alcohol use.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 7 in book.

_____ General feedback sought from group members.

Session 8:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: nutrition.

_____ Reviewed homework assignment: food diary.

_____ Group members completed homework checklist.

_____ Introduced effective communication skills: communicating with health professionals, assertiveness, active listening.

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 8 in book.

_____ General feedback sought from group members.

Session 9:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: communication skills.

_____ Reviewed homework assignment: assertive communication, listening and assertive responses.

_____ Group members completed homework checklist.

_____ Discussion of barriers to accomplishing goals.

_____ Discussion of ways of coping with problems (problem-solving).

_____ Session (information/discussion) reviewed.

_____ Homework assignment presented and discussed: Chapter 9 in book.

_____ General feedback sought from group members.

Session 10:

_____ Presented outline of session.

_____ Group members completed questionnaire on medication use.

_____ Reviewed previous session: problem-solving.

_____ Reviewed homework assignment: barriers to accomplishing goals.

_____ Group members completed homework checklist.

_____ Emphasized importance of regular rehearsal of skills.

_____ Discussion of resources available to assist with pain coping and/or difficulties that arise.

_____ Discussion of coping with flare-ups (planning for relapses), emphasizing daily management strategies, strategies for mild-moderate increases in pain, and strategies for severe pain increases.

_____ General review and discussion of program. Group members encouraged to raise questions, concerns, or ideas.

_____ Group members informed of individual sessions for assessment (post-treatment and follow-up). Sessions scheduled.

_____ General feedback sought from group members.

Appendix 0

Recruitment Poster Placed in the Manitoba MS Society Office

DO YOU LIVE WITH MS-RELATED PAIN?

Are you interested in participating in a research study that will assess the effectiveness of psychological interventions for pain management for MS-related pain?

By taking part in this study, you will have an opportunity to learn some strategies that may help you cope better with your pain. You will also have a chance, in a group setting, to share your experiences relating to pain. Your involvement will help us to better understand what strategies are most effective for individuals with MS-related pain.

The study is taking place this fall/winter and involves:

- Several individual interview sessions
- 10 weekly sessions with a small group of up to 10 individuals, all with MS
- Your commitment to attend meetings and practice strategies

Please note that all meetings will take place at the University of Manitoba.

Individuals taking part in this research will receive an honorarium of $25.

If you are interested in participating in this research project or would like additional information about the research, please contact Ms. Jennifer Garinger (Primary Investigator) as soon as possible, at:

Phone:

Email:

Appendix P

Recruitment Advertisement Placed in Manitoba MS Society's Newsletter

DO YOU LIVE WITH MS-RELATED PAIN?

Are you interested in participating in a research study that will assess the effectiveness of psychological interventions for pain management for MS-related pain?

By taking part in this study, you will have an opportunity to learn some strategies that may help you cope better with your pain. You will also have a chance, in a group setting, to share your experiences relating to pain. Your involvement will help us to better understand what strategies are most effective for individuals with MS-related pain.

The study is taking place this fall/winter and involves:

- Several individual interview sessions
- 10 weekly sessions with a small group of up to 10 individuals, all with MS
- Your commitment to attend meetings and practice strategies

Please note that all meetings will take place at the University of Manitoba.

Individuals taking part in this research will receive an honorarium of $25.

If you are interested in participating in this research project or would like additional information about the research, please contact Ms. Jennifer Garinger (Primary Investigator) as soon as possible, at:

Phone:

Email:

Appendix Q

Recruitment Advertisement Placed in the Manitoba Medical Association's Newsletter

MS-RELATED PAIN RESEARCH STUDY

We are currently recruiting participants for a study to assess the effectiveness of psychological interventions for pain management for MS-related pain. We are looking for individuals with MS-related pain who would be willing to take part in weekly group therapy sessions at the University of Manitoba. These sessions will take place this winter. Individuals taking part in this research will receive an honorarium of $25.

If you are aware of anyone who may be interested in participating in this study, please ask them to contact Ms. Jennifer Garinger (Primary Investigator) as soon as possible at:

Phone:

Email:

Appendix R

Recruitment Advertisement Placed in Winnipeg Free Press Newspaper

DO YOU LIVE WITH MS-RELATED PAIN?

If you have Multiple Sclerosis (MS) and have experienced physical pain for at least 1 month, you may be eligible to take part in a research study that will assess the effectiveness of psychological interventions for MS-related pain management.

For more information, please contact Jennifer Garinger at or by email at

Appendix S

Project Description and Consent Form – Study 2

Name of Project: Evaluating the Effects of Cognitive-Behavioral Group Treatment for Chronic Pain Management in Individuals with Multiple Sclerosis

You are being asked to take part in a research project that will study what pain management interventions are helpful to individuals with multiple sclerosis. The primary researchers on this project are Ms. Jennifer Garinger (University of Manitoba) and Dr. Michael Thomas (University of Manitoba). This project has been approved by the University of Manitoba Psychology/Sociology Research Ethics Board and the Health Sciences Centre Ethics Review Committee.

What is the study about?

The purpose of this study is to assess the effectiveness of psychological interventions for pain management for MS-related pain. If you agree to participate, you will participate in a cognitive-behavioral group treatment for pain. The cognitive-behavioral treatment involves looking at your thoughts (or cognitions) and behaviors relating to your pain. Sessions will include topics such as relaxation strategies, problem-solving skills, communication skills, learning to think more positively or realistically about situations, and learning how to slowly increase the amount of activity that you are able to engage in.

What are the benefits in taking part in this study?

By taking part in this study, you will have an opportunity to learn some strategies that may help you cope better with your pain. The treatment being studied has been found

to be of benefit to individuals suffering from chronic pain conditions, and it is expected that it will provide benefits to individuals with MS-related pain as well.

You will also have a chance, in a group setting, to share your experiences relating to pain. Your involvement will help us to better understand what strategies are most effective for individuals with MS-related pain. It is expected that the information gained from this study will help other individuals with MS-related pain in the future.

Is participation voluntary?

Taking part in this study is strictly voluntary. If you decide not to take part or if you decide to stop (which you may do at any time and for any reason), it will not affect any services you are getting now or could receive in the future.

What can I expect?

If you take part in this study, a research assistant will arrange several individual interview sessions with you, at different times, where information will be gathered about your health and related issues. In addition, the researcher will contact you twice per week by phone in the several weeks preceding the group sessions to ask you several questions about your pain that day. These phone calls will take no longer than 20 minutes. You will then take part in a series of 10 weekly sessions with a small group of up to 5 individuals, all with MS. For 4 weeks after your group ends, the researcher will follow-up with you twice per week by phone to ask you about your pain. Your participation in this study will require your time and therefore will involve your commitment to attend meetings and practice strategies.

Will my personal information be kept confidential?

Any personal information you provide us will be strictly confidential. The information will be stored in a locked office and will be available only to personnel of this project. The identity of any individual will not be disclosed in any presentations or publications about the project. Only group information will be used in any presentations or publications about this project.

Although the group sessions you will participate in will involve discussing personal information with a small group of people, group members will be informed about the importance of keeping all group discussions confidential. This will allow group members to share important issues for them without worrying that members will discuss this with people outside of the group.

In addition, the group sessions that you take part in will be audiotaped and may be listened to by other individuals in your group program if they are unable to attend a session. As with all written information, all of the audiotapes will be stored in a locked office and will be available only to personnel of this project. Once the study has been completed, all audiotapes will be erased.

How much time will it take?

The individual interview sessions may each take between 1 and 2 hours to complete. These sessions will be completed three times: (a) at the beginning of the study, (b) after approximately 10 weeks, and (c) after approximately 3 months. These sessions will be arranged at your convenience.

The group sessions will take place over 10 consecutive weeks. Each session will last for 1 hour. In the several weeks preceding these group sessions, during the 10 weeks that you are participating in the group, and in the 4 weeks after your group ends, the

researcher will also contact you by phone twice per week to ask you several pain questions. Each phone call will last no longer than 20 minutes.

What are the risks in taking part in this project?

There are no identified risks associated with the intervention being studied in this project. Although it is possible that discussing personal questions could result in some people feeling uncomfortable or stressed, it has been our experience, and that of other researchers, that people don't mind these procedures. Nevertheless, you do not have to answer any question that you do not want to.

Can I get a copy of this consent and the results of the study?

You can keep a copy of this consent form for your records. If you wish, we will also be happy to provide you information about the results of the study when it is completed.

Who should I talk to if I have questions, concerns, or complaints?

If, at any time, you have questions or concerns please feel free to contact:

Ms. Jennifer Garinger (University of Manitoba), 474-9222, or

Dr. Michael Thomas (University of Manitoba), 474-9222, or

Ms. Margaret Bowman (Human Ethics Secretariat, University of Manitoba), 474-7122.

Signatures

This study has been described to me by a project staff and I understand the nature and scope of my involvement. I will get a copy of this consent form.

1. I consent to participate in the study titled: "Evaluating the Effects of Cognitive-Behavioral Group Treatment for Chronic Pain Management in Individuals with Multiple

Sclerosis". I understand that the services of this program will be provided by Ms. Jennifer Garinger, who is a doctoral psychology student at the University of Manitoba, under the supervision of Dr. Michael Thomas (University of Manitoba). I also understand that the group sessions will be audiotaped and listened to group members who miss a session, and that these tapes will be erased after the completion of the study. I am aware that I may stop at any time with no impact on the services that I am getting or may receive in the future.

_____ Yes _____ No

2. I wish to obtain a summary of the results of this study once it is completed.

_____ Yes _____ No

If yes, I prefer to have a summary of the results provided to me by:

_____Email (email address: _____)

_____ Fax (fax number: _____)

_____Surface Mail (mailing address:

_____)

3. I consent to being contacted following the completion of this study for possible participation in further follow-up.

_____ Yes _____ No

_____ _____

Print Name of Consent Giver Signature of Consent Giver

_____

Date

Mailing Address and Phone Number of Participant:

The information within this consent has been explained to the participant and to the best of my knowledge the participant understands the nature of the study and the risks and benefits involved in this study.

_____	_____	_____
Print Name of Researcher	Signature of Researcher	Date

Appendix T

Satisfaction/Disappointment with Social Support Questions

1. Who was helpful to you in the past 24 hours in dealing with your pain – either by talking with you, comforting you, listening to you, giving you advice, or giving you practical assistance? (check all that apply)

_____ No one

_____ Spouse

_____ Brother/Sister

_____ Child(ren)

_____ Parent

_____ Parent-in-law

_____ Other relative

_____ Friend

_____ Neighbor

_____ Someone at work

_____ Someone else (who?_____)

2. Who disappointed you in the past 24 hours in helping you deal with your pain? (check all that apply)

_____ No one

_____ Spouse

_____ Brother/Sister

_____ Child(ren)

_____ Parent

_____ Parent-in-law

_____ Other relative

_____ Friend

_____ Neighbor

_____ Someone at work

_____ Someone else (who?_____)

Appendix U

Pain Information Collected During Ongoing Assessment in Baseline, Treatment, and Post-Treatment Phases

1. Rate the level of your pain in the past 24 hours.

1 2 3 4 5 6 7

No Pain Very Intense Pain

2. In the past 24 hours, how much has your pain problem interfered with your day to day activities?

1 2 3 4 5 6 7

No Interference Extreme Interference

3. In the past 24 hours, how much has your pain changed your ability to work?

1 2 3 4 5 6 7

No Change Extreme Change

_____ Check here if you have retired for reasons other than your pain problem.

4. In the past 24 hours, how much has your pain changed the amount of satisfaction or enjoyment you get from participating in social and recreational activities?

1 2 3 4 5 6 7

No Change Extreme Change

5. In the past 24 hours, how supportive or helpful has your significant other been to you in relation to your pain?

1 2 3 4 5 6 7

Not At All Extremely

Supportive Supportive

Who is your significant other who you are referring to in your answer to this question?

1. spouse
2. boyfriend who you have been dating for at least six months
3. girlfriend who you have been dating for at least six months
4. mother
5. father
6. sibling
7. friend

6. Rate your overall mood during the past 24 hours.

1 2 3 4 5 6 7

Extremely Extremely

Low Mood High Mood

7. In the past 24 hours, how severe has your pain been?

1 2 3 4 5 6 7

Not At All Extremely

Severe Severe

8. In the past 24 hours, how much has your pain changed your ability to participate in recreational and other social activities?

1 2 3 4 5 6 7

No Change Extreme Change

9. In the past 24 hours, how much has your pain changed the amount of satisfaction you get from family-related activities?

1 2 3 4 5 6 7

No Change Extreme Change

10. In the past 24 hours, how worried has your significant other been about you in relation to your pain problem?

1 2 3 4 5 6 7

Not At All Extremely

Worried Worried

Who is your significant other that you are referring to in your answer to this question?

1. spouse
2. boyfriend who you have been dating for at least six months
3. girlfriend who you have been dating for at least six months
4. mother
5. father
6. sibling
7. friend

11. In the past 24 hours, how much suffering have you experienced because of your pain?

1 2 3 4 5 6 7

No Suffering Extreme Suffering

12. In the past 24 hours, how much has your pain changed your marriage or family relationships?

1 2 3 4 5 6 7

No Change Extreme Change

13. In the past 24 hours, how much has your pain changed the amount of satisfaction and enjoyment you get from work?

1 2 3 4 5 6 7

No Change Extreme Change

_____ Check here if you are not presently working.

14. In the past 24 hours, how attentive has your significant other been to your pain problem?

1 2 3 4 5 6 7

Not At All Extremely

Attentive Attentive

Who is your significant other that you are referring to in your answer to this question?

1. spouse
2. boyfriend who you have been dating for at least six months
3. girlfriend who you have been dating for at least six months
4. mother
5. father
6. sibling
7. friend

15. In the past 24 hours, how much has your pain changed your ability to do household chores?

1 2 3 4 5 6 7

No Change Extreme Change

16. During the past 24 hours, how irritable have you been?

1 2 3 4 5 6 7

Not At All Extremely

Irritable Irritable

17. In the past 24 hours, how much has your pain changed your friendships with people other than your family?

1 2 3 4 5 6 7

No Change Extreme Change

18. In the past 24 hours, how tense or anxious have you been?

1 2 3 4 5 6 7

Not At All Extremely

Tense or Anxious Tense or Anxious

19. Who was helpful to you in the past 24 hours in dealing with your pain – either by talking with you, comforting you, listening to you, giving you advice, or giving you practical assistance? (check all that apply)

_____ No one

_____ Spouse

_____ Brother/Sister

_____ Child(ren)

_____ Parent

_____ Parent-in-law

_____ Other relative

_____ Friend

_____ Neighbor

_____ Someone at work

_____ Someone else (who?_____)

20. Who disappointed you in the past 24 hours in helping you deal with your pain?

(check all that apply)

_____ No one

_____ Spouse

_____ Brother/Sister

_____ Child(ren)

_____ Parent

_____ Parent-in-law

_____ Other relative

_____ Friend

_____ Neighbor

_____ Someone at work

_____ Someone else (who?_____)

21. In the past 24 hours, what pain medications have you taken?

Medication _____ Dosage _____

Medication _____ Dosage _____

Medication _____ Dosage _____

Medication _____ Dosage _____

Medication _____ Dosage _____

22. Has anything else happened in the past several days that has had any effect on you (good or bad)?

_____

_____

Appendix V

Rating of Homework Completed – Study 2

Today's Date: _____

How much time did you spend **in the past week** completing any work relating to this group:

_____

Table 1

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Kerns et al.	1986	28 adults	Assignment to: A. Wait-list control B. 10 hours of CBT: - training in attention diversion - relaxation - goal setting - pain education C. 10 hours of behavior therapy: - relaxation - identification of pain behaviors - training in extinction of pain	At post-treatment: - B and C improved more than A on health care service use - B improved more than C and A on pain severity, affective distress, disability, dependence on others At 3- and 6-month follow-up:

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Kerns et al.	1986	28 adults	behaviors - training in reinforcement of well behaviors	- Improvements maintained by B - No changes for A and C
Turner & Clancy	1988	81 adults	Assignment to: A. Wait-list control B. 16 hours of behavioral therapy: - education on pain behaviors - education on reinforcement - communication training - fitness training	At post-treatment: - B improved more than A and C on pain severity, disability, pain behaviors, and cognitive errors

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Turner & Clancy	1988	81 adults	C. 16 hours of CBT: - relaxation training - cognitive restructuring	- At 1 year follow-up: No difference between B and C
Nicholas et al.	1991	58 adults	Assignment to: A. No attention-control (physiotherapy sessions) B. Attention-control - physiotherapy sessions - 5 nondirective, supportive group sessions	At post-treatment: - Groups C, D, E, and F improved more than A & B on: pain severity, anxiety, depression, medication use, use of active coping

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Nicholas et al.	1991	58 adults	C. 17.5 hours of behavioral therapy: - pain education - goal setting - physiotherapy sessions D. 17.5 hours of behavioral therapy plus relaxation training E. 17.5 hours of CBT: - pain education cognitive restructuring - training in distraction - physiotherapy sessions	strategies, pain cognitions, disability - Groups C & D improved more than E & F on measures of disability and medication use At 6- and 12-month – follow-up: - No differences between C, D, E, or F

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Nicholas et al.	1991	58 adults	F. 17.5 hours of CBT plus relaxation training	
Vlaeyen et al.	1995	71 adults	Assignment to: A. Wait-list control B. 8 weeks of behavioral therapy: - goal setting - activity-rest contingency schedules - inclusion of significant others in sessions C. 8 weeks of behavioral therapy plus cognitive restructuring (CBT) D. 8 weeks of behavioral therapy	At post-treatment: - Groups B, C, & D improved more than A on measures of health behaviors, pain behaviors, affective distress, pain cognitions - Groups C & D improved more than

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Vlaeyen et al.	1995	71 adults	plus biofeedback	B on measures of physical fitness, pain impact, catastrophizing, outcome-efficacy beliefs At 6- and 12-month follow-up: - Improvements maintained for groups B, C, & D

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Turner	1982	36 adults	Assignment to: A. Wait-list control B. 7.5 hours of relaxation training C. 7.5 hours of CBT: - goal setting - relaxation training - cognitive restructuring	At post-treatment: - Groups B & C improved more than on measures of disability, depression, pain severity - No differences between B & C At 1-month follow-up:

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Turner	1982	36 adults		- C was only group to show further improvements
Flor & Birbaumer	1993	57 adults	Assignment to: A. Typical medical treatment (medication, nerve blocks, or chiropractic manipulation) B. 8 hours of biofeedback C. 8 hours of CBT: - relaxation training - problem-solving skills	At post-treatment: - Groups B & C improved more than A on measures of pain severity & catastrophizing - No differences between B & C

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Flor & Birbaumer	1993	57 adults	- positive self-statements - use of distraction	At 6-month follow-up: - B improved more than C on: - use of distraction, measures of pain severity, interference, & affective distress
Newton-John et al.	1995	44 adults	Assignment to: A. Wait-list control B. 16 hours of biofeedback	At post-treatment: - Groups B & C improved more than

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Newton-John et al.	1995	44 adults	C. 16 hours of CBT: - pain education - goal setting - activity scheduling - relaxation training - use of attention diversion - use of pain relabeling - cognitive restructuring	A on measures of depression, anxiety, pain coping strategies, pain beliefs, activity level, pain severity - No differences between B & C At 6-month follow-up:

Table 1 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with other psychological interventions and no-treatment controls

Study	Year	Participants	Interventions	Outcomes
Newton-John et al.	1995	44 adults		- Improvements maintained for both B & C

Table 2

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with non-psychological interventions

Study	Year	Participants	Interventions	Outcomes
Altmaier et al.	1992	45 adults	Assignment to either: A. Standard program - daily physical therapy - daily fitness training - pain education - vocational rehabilitation B. Standard program plus: - relaxation training - biofeedback - discussion of use of adaptive coping strategies	At post-treatment & 6-month follow-up: - No differences between A & B on measures of physical functioning, interference, ability to return to work, pain severity

Table 2 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with non-psychological interventions

Study	Year	Participants	Interventions	Outcomes
Nicholas et al.	1992	20 adults	Assignment to physiotherapy plus either: A. 17.5 hours of CBT: - pain education - goal setting - cognitive restructuring - relaxation training - use of distraction & pacing B. 17.5 hours of attention-control: - supportive, nondirective group sessions	At post-treatment: - A improved more than B on measures of disability, active coping, self-efficacy, medication use - No differences between groups on measures of pain severity and depression

Table 2 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with non-psychological interventions

Study	Year	Participants	Interventions	Outcomes
Nicholas et al.	1992	20 adults		At 6-month follow-up: - A maintained benefits
Basler et al.	1997	76 adults	Assignment to: A. Standard medical treatment (medications, physical therapy, or nerve blocks) B. 30 hours of CBT plus medical treatment: - pain education - relaxation training	At post-treatment: - B improved more than A on measures of pain severity, feeling of having control over one's pain, social

Table 2 (cont'd)

Summary of research comparing cognitive-behavioral group treatments (CBT) for chronic low back pain (CLBP) with non-psychological interventions

Study	Year	Participants	Interventions	Outcomes
Basler et al.	1997	76 adults	- cognitive restructuring - activity scheduling	functioning, activities requiring mental functioning - No differences on measures of social support, use of active coping strategies, physical performance

Table 3

Summary of research on the use of cognitive-behavioral group treatments (CBT) for rheumatoid arthritis (RA)

Study	Year	Participants	Interventions	Outcomes
O'Leary et al.	1988	30 women	Assignment to: A. Control group: - given pain management workbook - encouraged to increase activity B. 10 hours of CBT: - pain education - goal setting - relaxation training - use of attention refocusing - use of imagery - relabeling pain - self-encouragement	At post-treatment: - B improved more than A on measures of pain severity, joint impairment, self-efficacy - No differences on measures of depression, disability, activity level, stress, coping, loneliness, sleep

Table 3 (cont'd)

Summary of research on the use of cognitive-behavioral group treatments (CBT) for rheumatoid arthritis (RA)

Study	Year	Participants	Interventions	Outcomes
Appelbaum et al.	1988	18 men and women	Assignment to: A. Control (symptom monitoring) B. 10 sessions of CBT: - relaxation training - biofeedback - pain education - problem-solving skills - cognitive restructuring	At post-treatment: - B improved more than A on measures of pain severity, functional abilities, range of motion - No differences on measures of sleep, depression, anxiety At 18-month follow-up:

Table 3 (cont'd)

Summary of research on the use of cognitive-behavioral group treatments (CBT) for rheumatoid arthritis (RA)

Study	Year	Participants	Interventions	Outcomes
Appelbaum et al.	1988	18 men and women		- No differences
Radojevic et al.	1992	59 men and women	Assignment: A. No-treatment control B. 6 hours of CBT: - pain education - cognitive restructuring - relaxation training C. 6 hours of CBT plus family support (reinforcement of positive behaviors & extinction of negative behaviors D. 6 hours of pain education	At post-treatment: - Groups B & C improved more than A & D on measures of joint swelling - No differences on measures of pain severity, affective distress At 2-month follow-up:

Table 3 (cont'd)

Summary of research on the use of cognitive-behavioral group treatments (CBT) for rheumatoid arthritis (RA)

Study	Year	Participants	Interventions	Outcomes
Radojevic et al.	1992	59 men and women	plus family support	- Improvements maintained for B & C
Kraaimaat et al.	1995	77 men and women	Assignment to: A. Wait-list control B. 20 hours of occupational therapy plus pain education C. 20 hours of CBT: -pain education - relaxation training - goal setting - training in distraction & pacing - cognitive restructuring	At post-treatment: - Groups B & C improved more than A on measure of RA knowledge - Group C improved more than A & B on use of distraction - No differences on measures of pain

Table 3 (cont'd)

Summary of research on the use of cognitive-behavioral group treatments (CBT) for rheumatoid arthritis (RA)

Study	Year	Participants	Interventions	Outcomes
Kraaimaat et al.	1995	77 men and women		severity, mobility, self-care, anxiety, depression, social functioning At 6-month follow-up: - All groups reported increases in pain severity & depression & decrease in social support received

Table 3 (cont'd)

Summary of research on the use of cognitive-behavioral group treatments (CBT) for rheumatoid arthritis (RA)

Study	Year	Participants	Interventions	Outcomes
Sinclair & Wallston	2001	90 women	7.5 hours of CBT: - cognitive restructuring - development of strategies to deal with interpersonal relationships	At post-treatment: - Improvements on measures of self-efficacy, fatigue, & positive & negative affect

Table 4

Study 1: Descriptive statistics for pain-related measures (interval data) at pre-, post-, and follow-up assessments

	Pre-treatment				Post-treatment				3-month follow-up			
Measure	Mean	*SD*	Median	Range	Mean	*SD*	Median	Range	Mean	SD	Median	Range
Number of pain sites reported	3	1.6	3	1 - 6	4	1.4	4.5	2 - 6	3	1.7	3	1 - 6
Number of pain medications taken	2.5	1.7	2	0 - 5	2.1	1.1	2.5	0 - 3	2	1.4	2.5	0 - 4
MQS (Total Score)	13.8	11.4	11.4	0 – 33.5	14.7	9	15	0 – 27.7	14.1	14	14.4	0 - 39
% relief provided by medications	36	39	25	0 - 100	55	35	50	0 – 100	54	40	60	0 - 100

Table 5

Study 1: Percentage of participants reporting experiencing pain in the following locations at pre-treatment, post-treatment, and follow-up assessments

Location	Pre-Treatment	Post-Treatment	Three-Month Follow-up
Arms/hands	88%	100%	75%
Legs	75%	88%	75%
Feet	75%	88%	75%
Back	38%	63%	38%
Torso	38%	38%	25%
Head/face	25%	50%	38%

Note. Multiple responses reported. Totals will add up to more than 100%.

Table 6

Study 1: Percentage of participants reporting taking various types of medication relating to their pain at pre-treatment, post-treatment, and follow-up assessments

Medication Class	Pre-Treatment	Post-Treatment	3-Month Follow-up
Anticonvulsants	57%	71%	83%
Muscle relaxants	43%	43%	50%
Non-steroidal anti-inflammatories	43%	43%	0%
Selective serotonin reuptake inhibitors	29%	29%	33%
Sedatives	29%	29%	17%
Schedule II opioids	14%	14%	17%
Acetaminophen	14%	0%	17%
Tricyclic antidepressants	14%	0%	0%
Benzodiazepines	14%	0%	17%
Miscellaneous analgesics	14%	0%	0%
Cannabinoids	0%	0%	17%
Antipsychotics	0%	14%	17%

Note. Multiple responses reported. Totals will add up to more than 100%.

Table 7

Study 1: Means, SDs, and ANOVA results for outcome measures at pre-, post-, and follow-up assessments

	Pre-treatment		Post-treatment		3-month follow-up		ANOVA results
Outcome Measure	Mean	*SD*	Mean	*SD*	Mean	*SD*	
Pain severity (numeric rating scale)	4.3	1.7	3.8	1.8	3.7	1.8	$F(2, 21) = 0.31, p = 0.73$
Pain severity (WHYPMI)	4.3	1.1	3.6	1.3	3.6	1.3	$F(2, 21) = 0.77, p = 0.48$
Interference due to pain (WHYMPI)	4.3	1.0	3.9	0.9	3.8	1.0	$F(2, 21) = 0.37, p = 0.73$
Interference due to pain (PDI total score)	35	10	31	13	28	19	$F(2, 21) = 0.52, p = 0.60$
Affective distress (WHYMPI)	3.3	1.2	3.0	1.0	3.2	2.0	$F(2, 21) = 0.17, p = 0.85$
Affective distress (SCL90-R)	1.2	0.7	0.9	0.6	1.0	0.5	$F(2, 21) = 0.47, p = 0.63$

Table 8

Study 1: Pearson correlations between medication use and the three outcome measures

	Interference due to Pain		Pain Severity		Affective Distress	
	WHYMPI	PDI	WHYMPI	NRS [a]	WHYMPI	SCL90-R
MQS-III	0.25	0.30	0.12	0.19	0.47*	0.08

[a] NRS = Numeric Rating Scale

* $p < 0.05$

Table 9

Study 1: Participant scores on outcome measures at pre-, post-, and follow-up assessments

Participant	Time	Pain Severity (NRS) [a]	Pain Severity (WHYMPI)	Interference (WHYMPI)	Interference (PDI)	Distress (WHYMPI)	Distress (SCL90-R)
1	Pre	3.0	4.0	4.1	39	2.3	0.92
	Post	5.0	4.0	4.4	38	2.3	0.34
	Follow-up	5.0	4.3	4.2	40	2.7	0.89
2	Pre	7.0	6.3	4.7	37	6.0	1.34
	Post	5.0	5.3	4.4	55	4.0	0.91
	Follow-up	5.0	5.7	4.8	55	4.7	1.09
3	Pre	3.0	3.3	2.6	29	3.3	0.88
	Post	3.0	3.7	3.7	25	4.7	0.70
	Follow-up	4.0	3.0	3.4	35	4.3	0.84
4	Pre	2.0	3.0	3.8	27	2.3	0.84
	Post	3.0	2.3	5.0	22	1.0	0.64

Table 9 (cont'd)

Study 1: Participant scores on outcome measures at pre-, post-, and follow-up assessments

Participant	Time	Pain Severity (NRS) [a]	Pain Severity (WHYMPI)	Interference (WHYMPI)	Interference (PDI)	Distress (WHYMPI)	Distress (SCL90-R)
4	Follow-up	1.5	2.0	2.8	35	1.7	0.47
5	Pre	5.0	4.3	3.2	40	3.7	1.87
	Post	4.0	4.3	2.4	20	3.3	1.62
	Follow-up	6.0	5.3	2.3	19	3.3	1.17
6	Pre	6.0	5.3	6.3	54	3.3	2.53
	Post	5.0	4.0	4.3	43	3.3	2.02
	Follow-up	3.0	3.7	5.8	45	4.3	1.73
7	Pre	5.0	4.3	4.9	21	3.3	0.74
	Post	5.0	4.3	4.2	25	3.7	1.04
	Follow-up	4.0	3.3	4.8	22	4.3	1.38
8	Pre	3.5	4.0	4.6	34	2.5	0.53

Table 9 (cont'd)

Study 1: Participant scores on outcome measures at pre-, post-, and follow-up assessments

Participant	Time	Pain Severity (NRS) [a]	Pain Severity (WHYMPI)	Interference (WHYMPI)	Interference (PDI)	Distress (WHYMPI)	Distress (SCL90-R)
8	Post	0	1.0	2.8	20	1.3	0.27
	Follow-up	1.0	1.7	2.6	2	0.30	0.21

[a] NRS = Numeric Rating Scale

Table 10

Study 2: Characteristics of those completing treatment and those who did not complete treatment (interval data)

Measure	Completers (n = 9) Mean (*SD*)	Noncompleters (n = 5) Mean (*SD*)
Age	51 (12)	49 (6)
Years of education	15 (3.5)	17 (2)
Years with MS	14.6 (14.6)	18.8 (7.4)
Years with pain	8.5 (6)	9.2 (6)
MQS total score	20 (16)	3.7 (5)
Social support (WHYMPI)	5.5 (1.4)	5.3 (2.5)
Pain severity (NRS)[a]	4.7 (1.7)	4.3 (2.6)
Pain severity (WHYMPI)	4.8 (1.2)	3.7 (1.7)
Interference due to pain (WHYMPI)	4.5 (1.3)	4.1 (1.3)
Interference due to pain (PDI)	42 (17)	31 (8.5)
Affective distress (WHYMPI)	3.6 (1.8)	2.5 (0.6)
Affective distress (SCL90-R)	1.2 (0.6)	0.7 (0.4)

[a] NRS = Numeric Rating Scale

Table 11

Study 2: Characteristics of those completing treatment and those who did not complete treatment (nominal data)

Measure	Completers (n = 9)	Noncompleters (n = 5)
Gender (male : female)	3 : 6	2 : 3
Marital status	6 married	1 married
	3 common-law	2 single
		1 separated
		1 divorced
Employment status	1 full-time work	1 part-time work
	1 part-time work	4 on disability
	5 on disability/2 retired	
MS subtype	5 relapse-remitting	2 relapse-remitting
	1 secondary-progressive	2 secondary-progressive
	3 unknown	1 primary-progressive

Table 12

Study 2: Characteristics of those recruited through the MS clinic and those through community sources (interval data)

Measure	Clinic (n = 6) Mean (*SD*)	Community (n = 3) Mean (*SD*)
Age	46 (4)	61 (17)
Years of education	14.5 (3.3)	16.7 (4)
Years with MS	9 (7)	25 (22)
Years with pain	8 (9.5)	9.5 (11)
MQS total score	28 (13)	4.4 (6)
Social support (WHYMPI)	5.7 (1.1)	5 (2.2)
Satisfaction with support	1.2 (0.8)	1 (0)
Disappointment with support	0.33 (0.5)	0.33 (0.6)
Pain severity (NRS) [a]	5.3 (1.5)	3.3 (1.2)
Pain severity (WHYMPI)	5.2 (0.7)	4 (1.7)
Interference due to pain (WHYMPI)	4.7 (1.3)	4 (1.5)
Interference due to pain (PDI)	45 (18)	37 (15)
Affective distress (WHYMPI)	4.2 (1.8)	2.3 (1)
Affective distress (SCL90-R)	1.5 (0.6)	0.8 (0.2)

[a] NRS = Numeric Rating Scale

Table 13

Study 2: Characteristics of those recruited through the MS clinic and those through community sources (nominal data)

Measure	Clinic ($n = 6$)	Community ($n = 3$)
Gender (male : female)	2 : 4	1 : 2
Marital status	3 married	3 married
	3 common-law	
Employment status	1 part-time work	1 full-time work
	5 on disability	2 retired
MS subtype	5 relapse-remitting	1 secondary-progressive
	1 unknown	2 unknown

Table 14

Study 2: Descriptive statistics for pain-related measures (interval data) at pre-, post-, and follow-up assessments

	Pre-treatment				Post-treatment				3-month follow-up			
Measure	Mean	SD	Median	Range	Mean	*SD*	Median	Range	Mean	*SD*	Median	Range
Number of pain sites reported	5	1.9	5	1 – 6	4	1.6	5	1 - 6	3.3	1.6	3	1 - 6
Number of pain medications taken	4	2.7	3	0 - 8	3	2	3	0 - 6	3	2	3	0 - 6
MQS (Total Score)	20	16	13	0 – 41	13	13	12	0 – 33	13	13	12	0 - 33
% relief provided by medications	64	16	70	40 – 80	56	31	55	10 – 100	43	25	40	0 - 80
Pain-related social support (WHYMPI)	5.5	1.4	5.7	3 - 7	5.2	1.6	5.7	3 - 7	4.9	1.7	5	2 – 7
Number of sources of support one was satisfied with	1.1	0.6	1	0 – 2	1.3	0.5	1	1 – 2	1.2	0.4	1	1 – 2
Number of sources of support one was disappointed with	0.3	0.5	0	0 – 1	0.1	0.3	0	0 – 1	0.1	0.3	0	0 - 1

Table 15

Study 2: Percentage of participants reporting experiencing pain in the following locations at pre-treatment, post-treatment, and follow-up assessments

Location	Pre-Treatment	Post-Treatment	Three-Month Follow-up
Legs	89%	89%	67%
Feet	89%	89%	78%
Arms/hands	78%	78%	67%
Head/face	78%	56%	44%
Back	67%	56%	44%
Torso	56%	44%	33%

Note. Multiple responses reported. Totals will add up to more than 100%.

Table 16

Study 2: Percentage of participants reporting taking various types of medication relating to their pain at pre-treatment, post-treatment, and follow-up assessments

Medication Class	Pre-Treatment	Post-Treatment	3-Month Follow-up
Selective serotonin reuptake inhibitors	63%	83%	83%
Schedule II opioids	63%	67%	67%
Non-steroidal anti-inflammatories	50%	33%	33%
Acetaminophen	50%	33%	17%
Anticonvulsants	38%	67%	67%
Muscle relaxants	25%	33%	33%
Antihypertensives	25%	0%	0%
Benzodiazepines	13%	17%	17%
Tricyclic antidepressants	13%	0%	0%
Antipsychotics	13%	17%	17%
Steroids	13%	0%	0%

Note. Multiple responses reported. Totals will add up to more than 100%.

Table 17

Study 2: Pearson correlations between social support measures with the three outcome measures prior to treatment ($n = 9$)

Social Support Measures	Interference due to Pain		Pain Severity		Affective Distress	
	WHYMPI	PDI	WHYMPI	NRS [a]	WHYMPI	SCL90-R
WHYMPI	-0.33	-0.33	-0.14	-0.20	-0.24	-0.22
Satisfaction with Support	0.50	0.14	0.22	0.40	-0.22	-0.30
Disappointment with Support	0.07	0.14	0.26	0.30	0.60	0.40

[a] NRS = Numeric Rating Scale

Table 18

Study 2: Phase means for each participant across all three study phases (baseline, treatment, and post-treatment)

Participant	WHYMPI - Interference			WHYMPI - Pain Severity			WHYMPI - Affective Distress			MQS-III		
	B[a]	T[b]	PT[c]	B[a]	T[b]	PT[c]	B[a]	T[b]	PT[c]	B[a]	T[b]	PT[c]
1	4.5	6.3	6.1	6.6	5.6	5.6	5.2	4.7	2.4	19	10	9
2	4.0	5.0	5.4	4.6	3.9	4.0	3.5	2.6	1.6	19	9	7
3	3.5	5.2	5.1	4.6	4.7	3.8	3.8	4.8	1.4	18	12	13
4	4.4	5.2	4.1	5.0	4.2	2.9	4.4	3.1	1.9	47	42	32
5	2.0	2.9	3.9	3.9	4.8	4.0	1.9	2.1	2.1	0	0.4	0
6	3.9	3.1	3.8	3.8	4.7	4.9	3.2	2.4	2.2	29	24	31
7	5.7	5.7	5.5	5.7	5.8	6.0	3.1	3.3	3.3	7	3	0.6
8	4.8	4.3	4.0	4.8	4.6	3.6	3.4	2.4	1.7	3	3	0
9	4.2	5.2	5.3	4.2	4.1	4.4	1.9	2.3	2.7	31	19	19

[a] B = baseline phase; [b] T = treatment phase; [c] PT = post-treatment phase

Table 19

Study 2: Number (and percentage) of participants exhibiting statistically significant differences on outcome measures for those individuals whose data was analyzed with statistical procedures

	Changes from Baseline to Treatment			Changes from Baseline to Post-Treatment		
Measure	Improved	Deteriorated	No Change	Improved	Deteriorated	No Change
WHYMPI – Interference due to pain	0	4 (57%)	3 (43%)	1 (14%)	4 (57%)	2 (29%)
WHYMPI – Pain severity	0	0	4 (100%)	1 (25%)	0	3 (75%)
WHYMPI – Affective distress	1 (25%)	0	3 (75%)	3 (75%)	0	1 (25%)

Table 20

Study 2: Number (and percentage) of participants exhibiting clinically significant differences on outcome measures

	Changes from Baseline to Treatment			Changes from Baseline to Post-Treatment		
Measure	Improved	Deteriorated	No Change	Improved	Deteriorated	No Change
WHYMPI – Interference due to pain	1 (11%)	4 (44%)	4 (44%)	1 (11%)	4 (44%)	4 (44%)
WHYMPI – Pain severity	1 (13%)	1 (13%)	6 (75%)	2 (25%)	0	6 (75%)
WHYMPI – Affective distress	3 (33%)	2 (22%)	4 (44%)	6 (67%)	2 (22%)	1 (11%)

Note. RCI calculations only completed for eight participants on the measure of Pain Severity (WHYMPI).

Figure Captions

Figure 1. Study 1 - Participants' scores at pre-treatment, post-treatment, and three-month follow-up assessments on two measures of pain severity (a numeric rating scale and the WHYMPI Pain Severity subscale).

Figure 2. Study 1 - Participants' scores at pre-treatment, post-treatment, and three-month follow-up assessments on two measures of interference due to pain (the WHYMPI Interference subscale and the PDI Total score).

Figure 3. Study 1 - Participants' scores at pre-treatment, post-treatment, and three-month follow-up assessments on two measures of affective distress (the WHYMPI Affective Distress subscale and the SCL90-R GSI).

Figure 4. Study 1 - Percentage of participants exhibiting no change, a decrease in symptoms, and an increase in symptoms between pre-treatment and post-treatment assessments on six outcome measures.

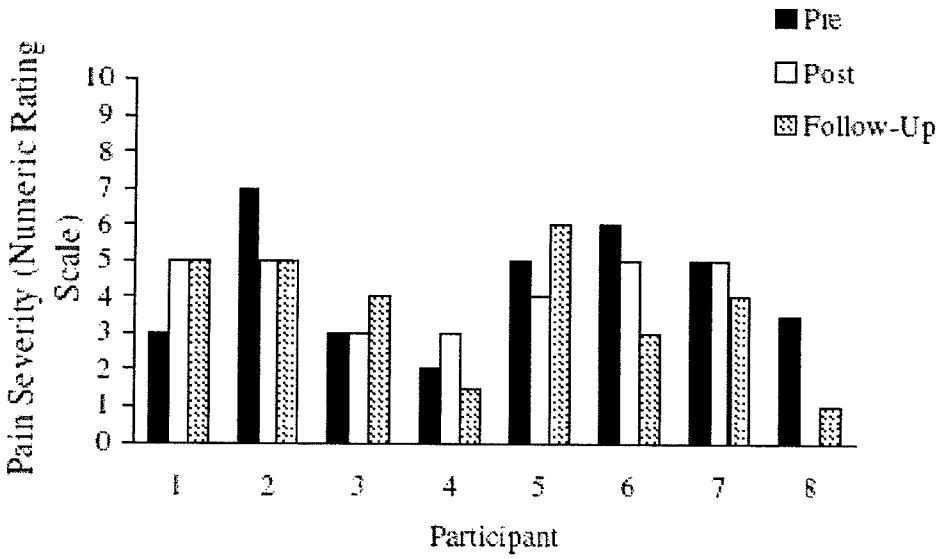
Figure 5. Study 1 - Percentage of participants exhibiting no change, a decrease in symptoms, and an increase in symptoms between pre-treatment and three-month follow-up assessments on six outcome measures.

Figure 6. Study 1 - Percentage of participants exhibiting no change, a decrease in symptoms, and an increase in symptoms between post-treatment and three-month follow-up assessments on six outcome measures.

Figure 7. Study 2 – Multiple baseline data on the measure of pain severity (WHYMPI) for Participants 1 through 4.

Figure 8. Study 2 – Multiple baseline data on the measure of pain severity (WHYMPI) for Participants 5 through 9.

Figure 1


Pre
Post
Follow-Up
Pain Severity (Numeric Rating Scale)
0
1
2
3
4
5
6
7
8
9
10
1
2
3
4
5
6
7
8
Participant

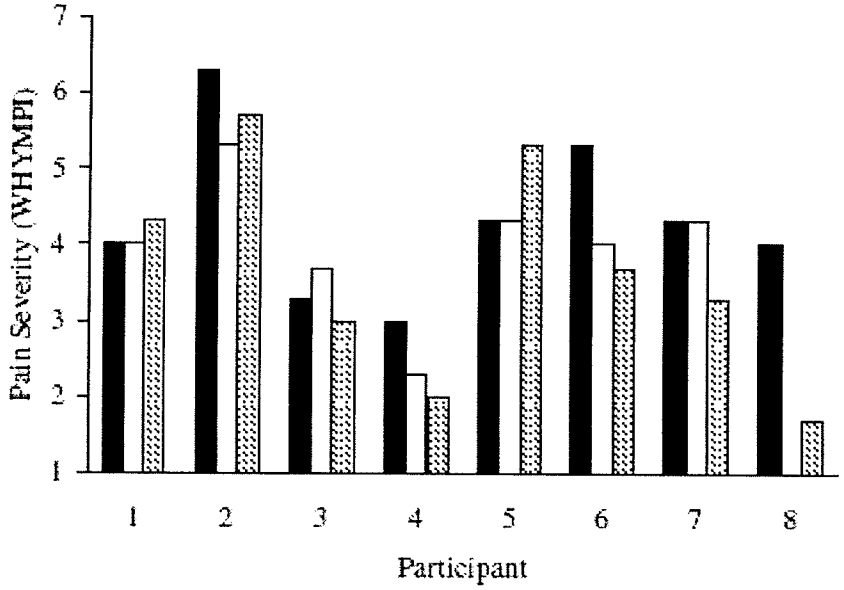
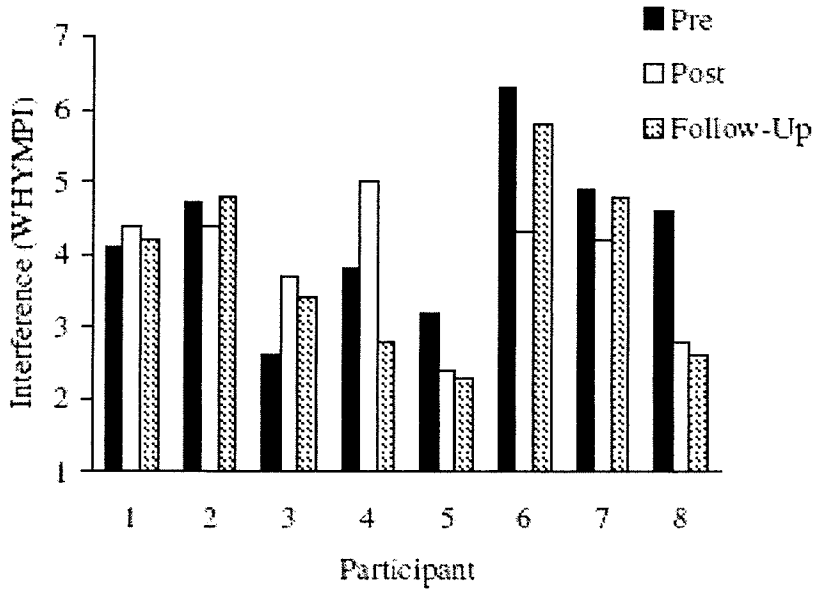

Pain Severity (WHYMPI)
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
Participant

Figure 2


Pre
Post
Follow-Up
Interference (WHYMPI)
7
6
5
4
3
2
1
1 2 3 4 5 6 7 8
Participant

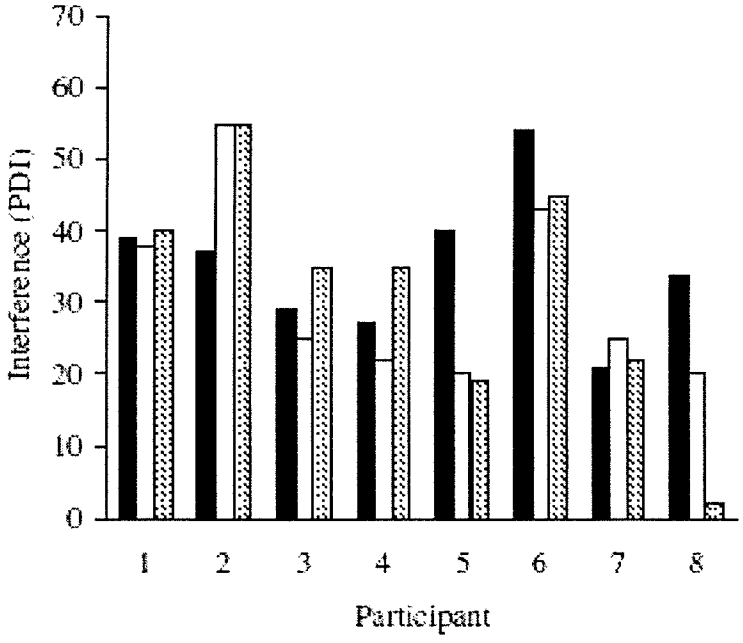
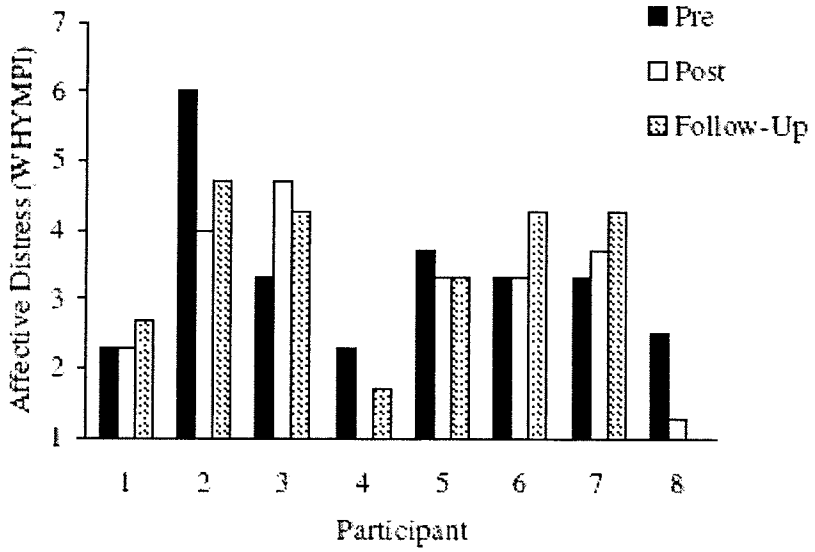

Interference (PDI)
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8
Participant

Figure 3


Pre
Post
Follow-Up
Affective Distress (WHYMPI)
7
6
5
4
3
2
1
1
2
3
4
5
6
7
8
Participant

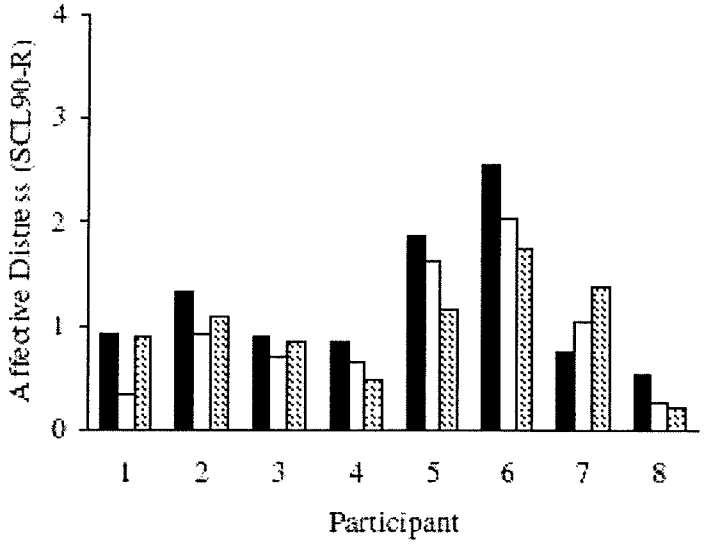

Affective Distress (SCL90-R)
4
3
2
1
0
1
2
3
4
5
6
7
8
Participant

Figure 4

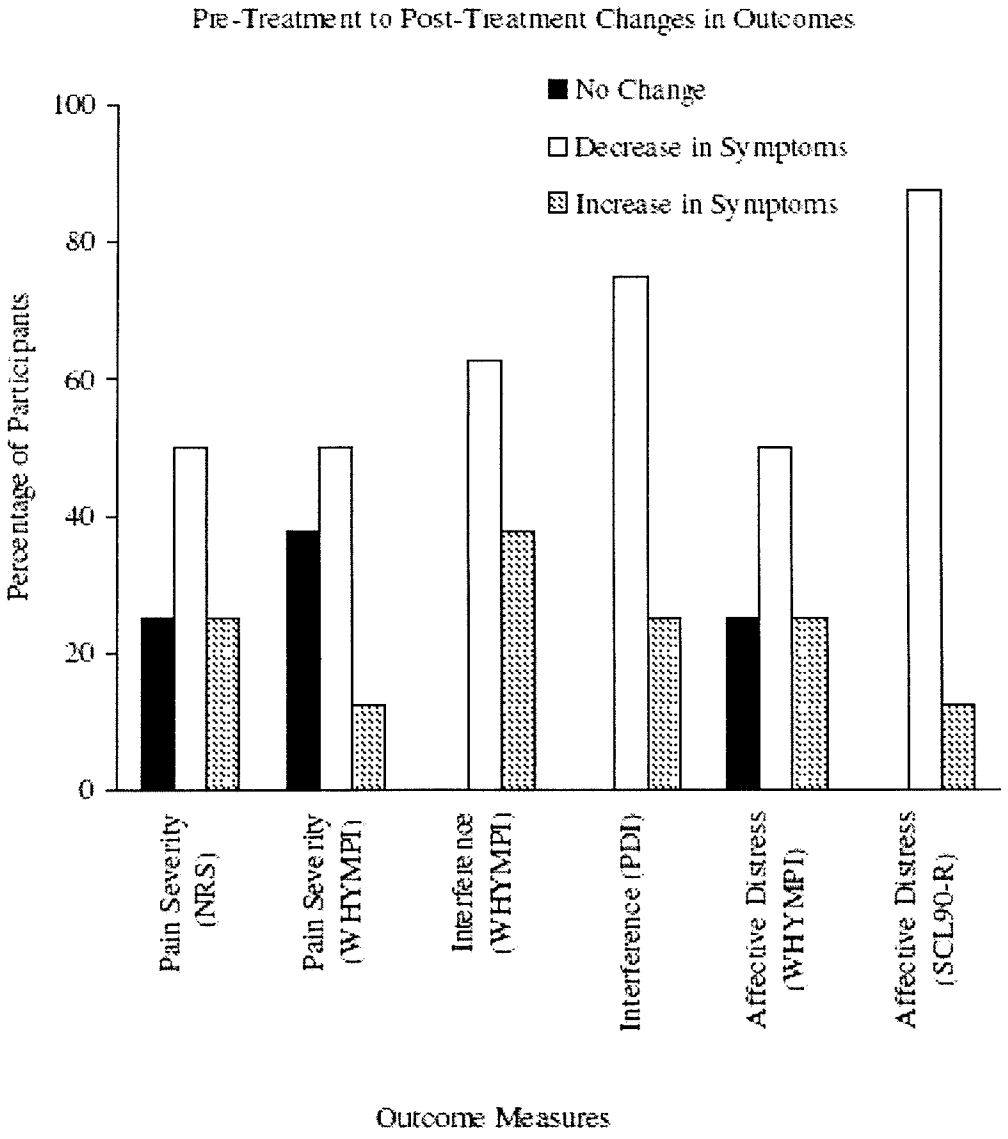

Pre-Treatment to Post-Treatment Changes in Outcomes
No Change
Decrease in Symptoms
Increase in Symptoms
Percentage of Participants
100
80
60
40
20
0
Pain Severity (NRS)
Pain Severity (WHYMPI)
Interference (WHYMPI)
Interference (PDI)
Affective Distress (WHYMPI)
Affective Distress (SCL90-R)
Outcome Measures

Figure 5

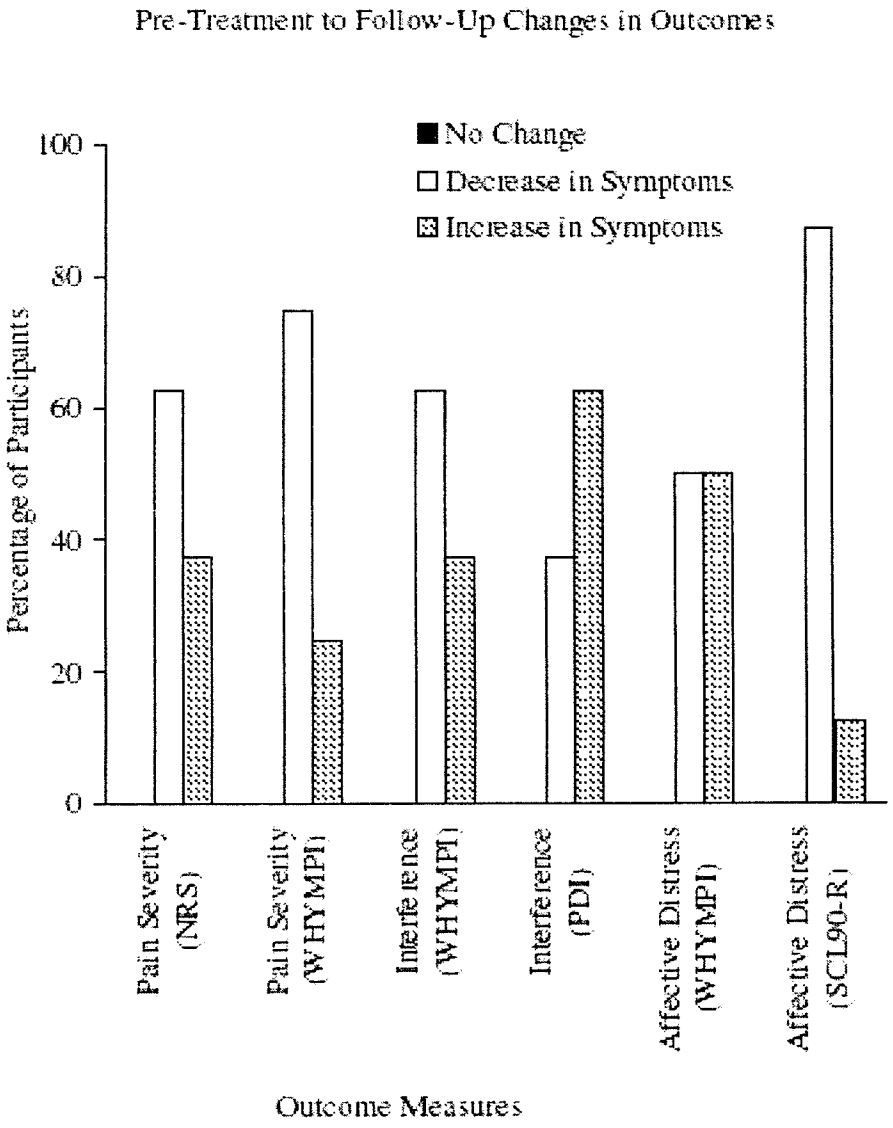

Pre-Treatment to Follow-Up Changes in Outcomes
No Change
Decrease in Symptoms
Increase in Symptoms
Percentage of Participants
100
80
60
40
20
0
Pain Severity (NRS)
Pain Severity (WHYMPI)
Interference (WHYMPI)
Interference (PDI)
Affective Distress (WHYMPI)
Affective Distress (SCL90-R)
Outcome Measures

Figure 6

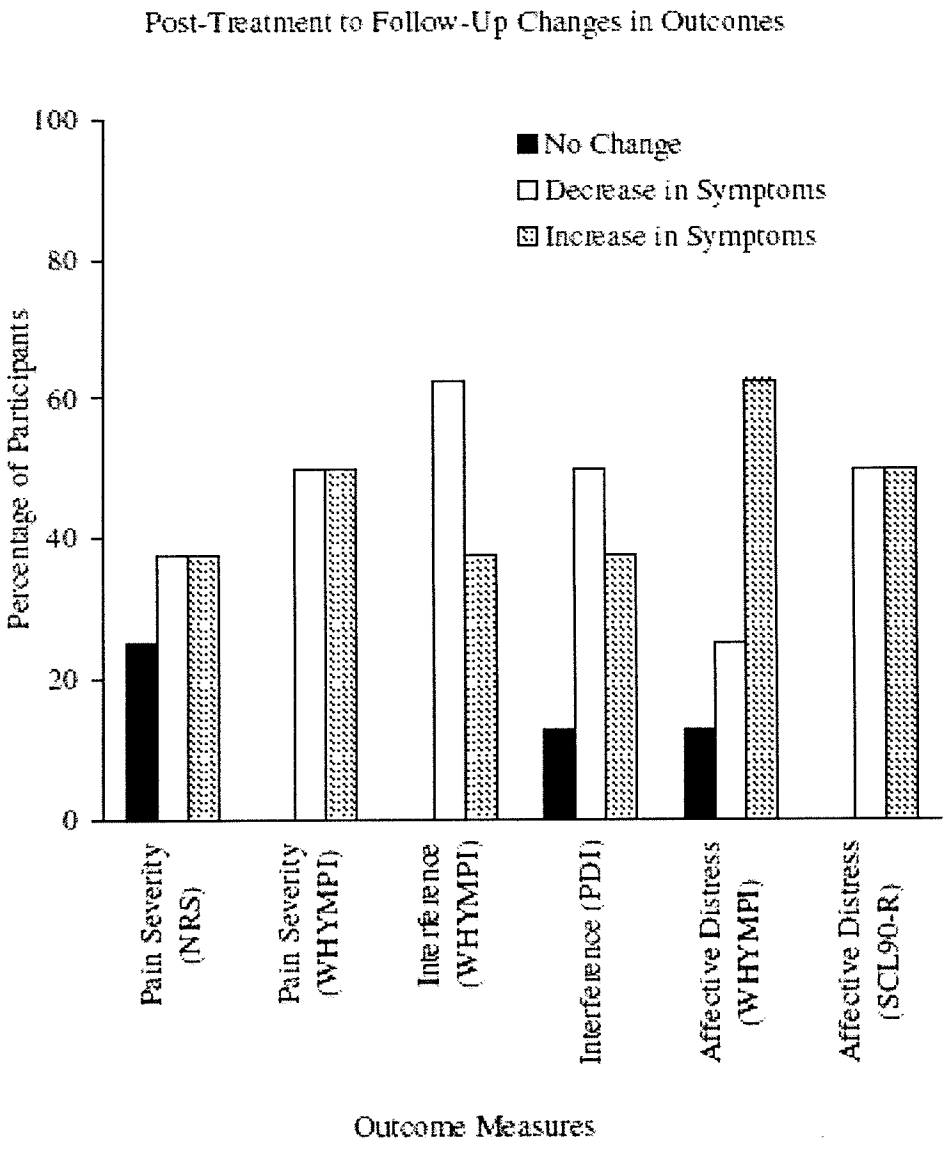

Post-Treatment to Follow-Up Changes in Outcomes
No Change
Decrease in Symptoms
Increase in Symptoms
Percentage of Participants
100
80
60
40
20
0
Pain Severity (NRS)
Pain Severity (WHYMPI)
Interference (WHYMPI)
Interference (PDI)
Affective Distress (WHYMPI)
Affective Distress (SCL90-R)
Outcome Measures

Figure 7

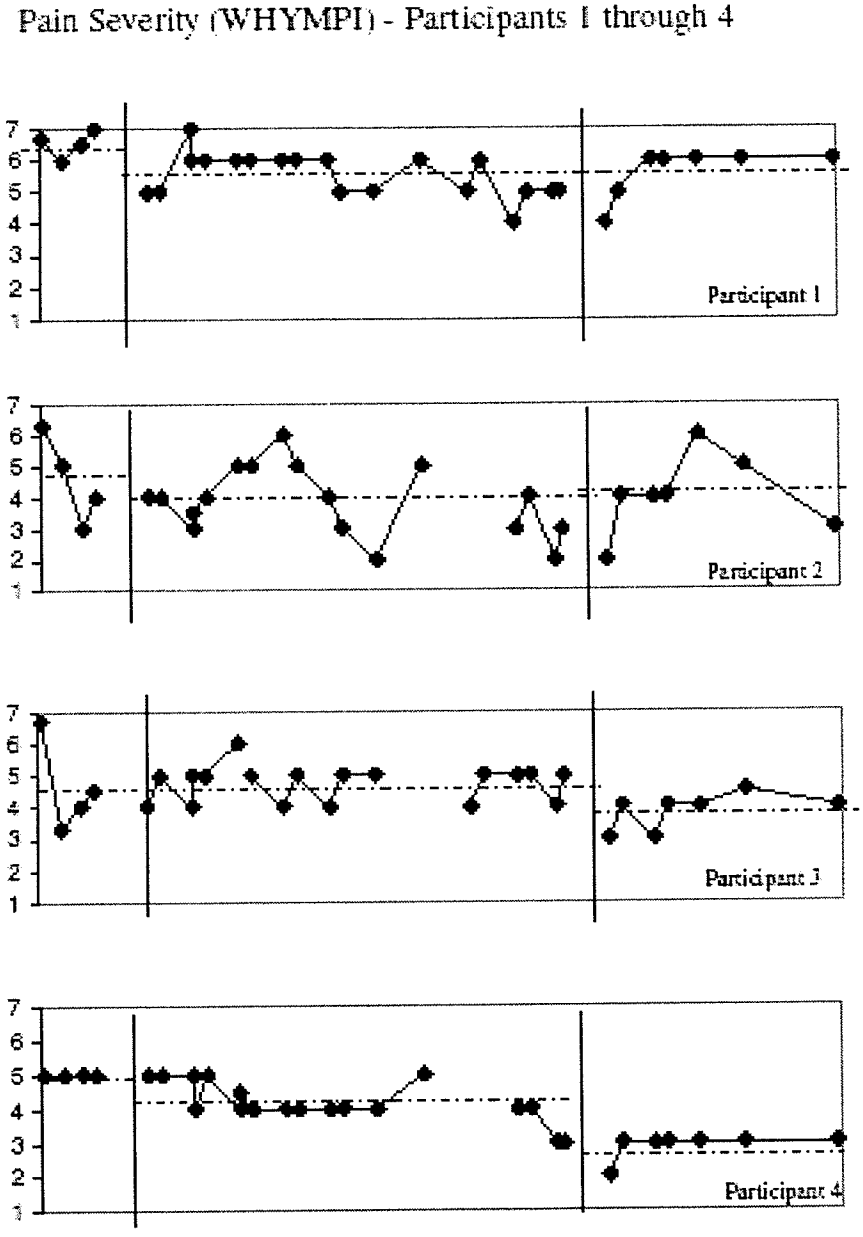

Pain Severity (WHYMPI) - Participants 1 through 4
Participant 1
Participant 2
Participant 3
Participant 4

Figure 8

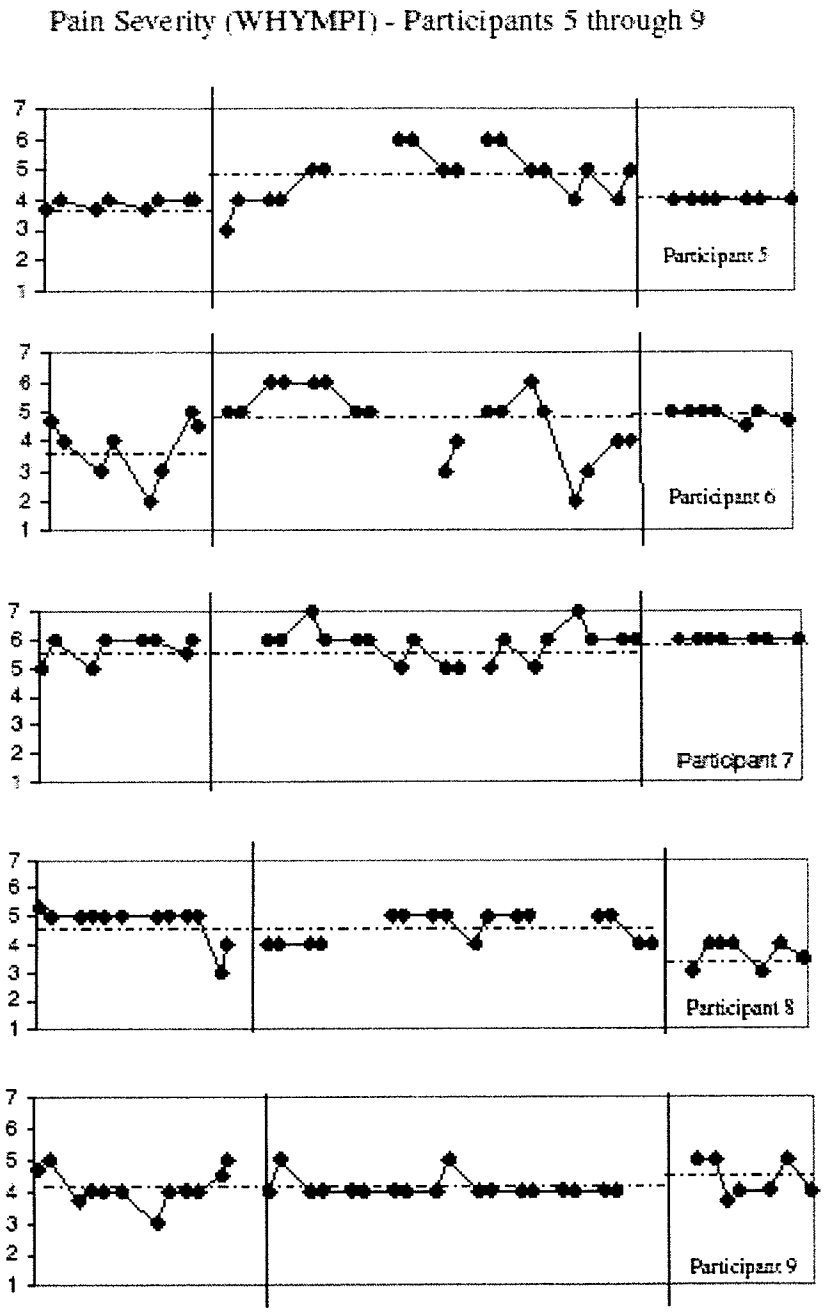

Pain Severity (WHYMPI) - Participants 5 through 9
Participant 5
Participant 6
Participant 7
Participant 8
Participant 9

Figure 9

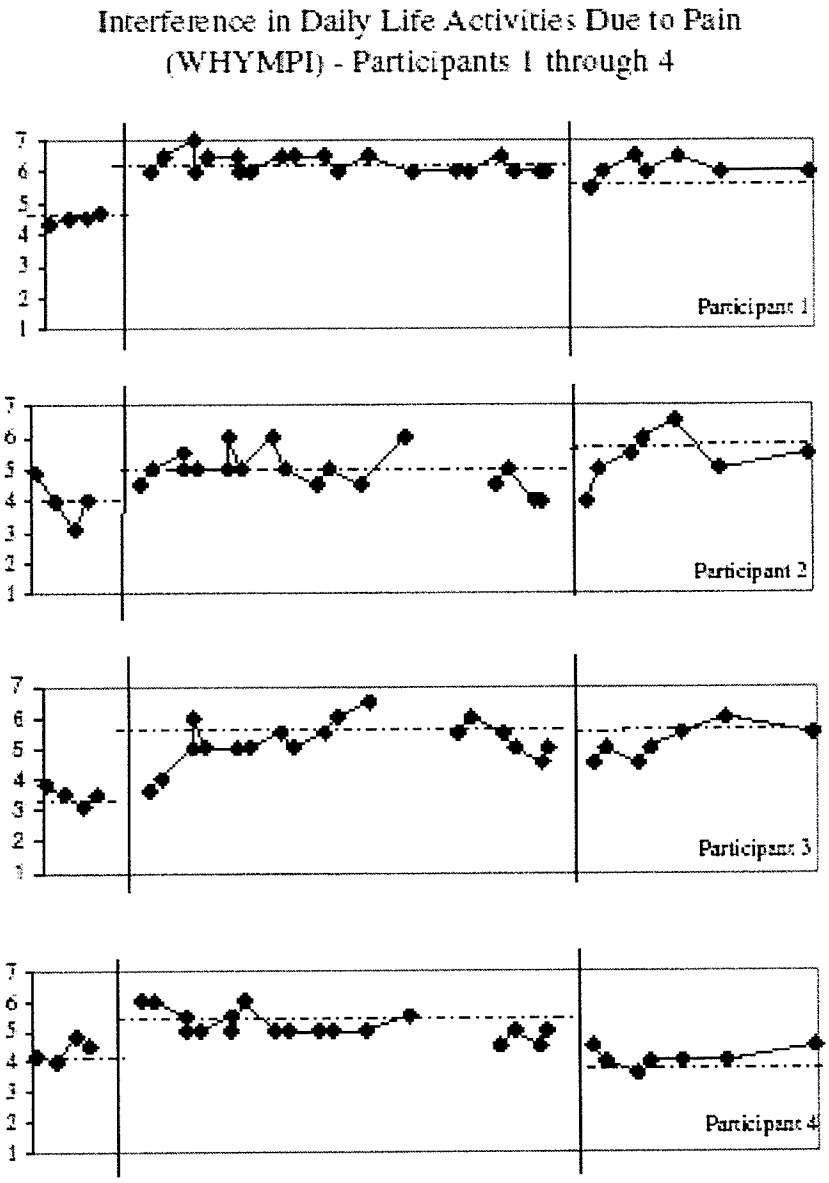

Interference in Daily Life Activities Due to Pain
(WHYMPI) - Participants 1 through 4
Participant 1
Participant 2
Participant 3
Participant 4

Figure 10

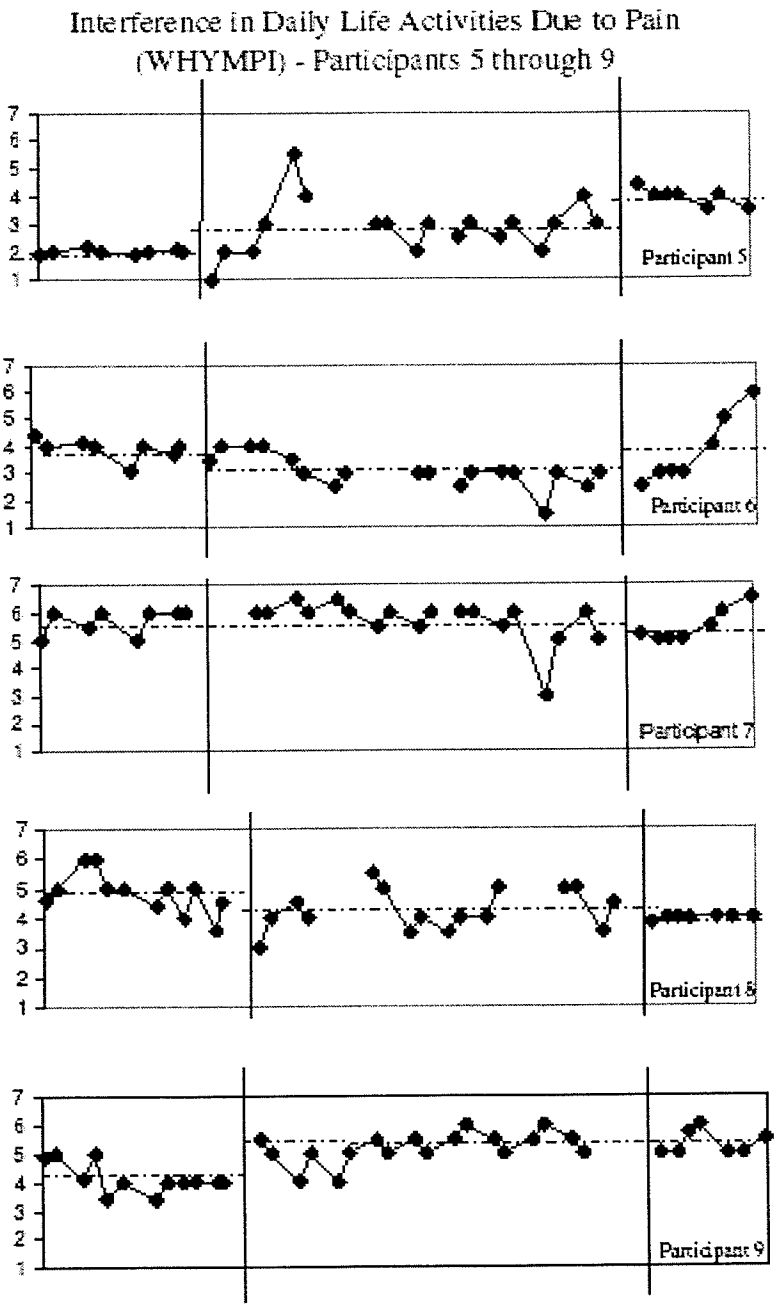

Interference in Daily Life Activities Due to Pain
(WHYMPI) - Participants 5 through 9
Participant 5
Participant 6
Participant 7
Participant 8
Participant 9

Figure 11

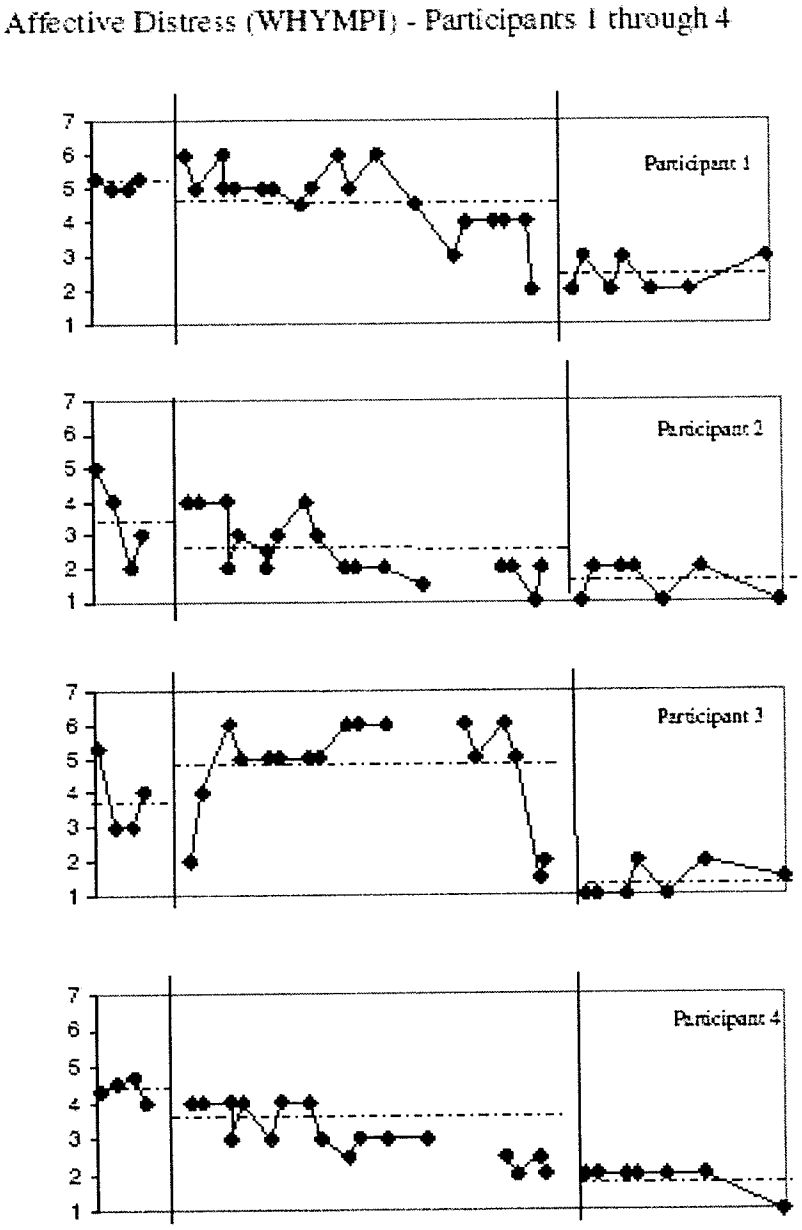

Affective Distress (WHYMPI) - Participants 1 through 4
Participant 1
Participant 2
Participant 3
Participant 4
7
6
5
4
3
2
1

Figure 13

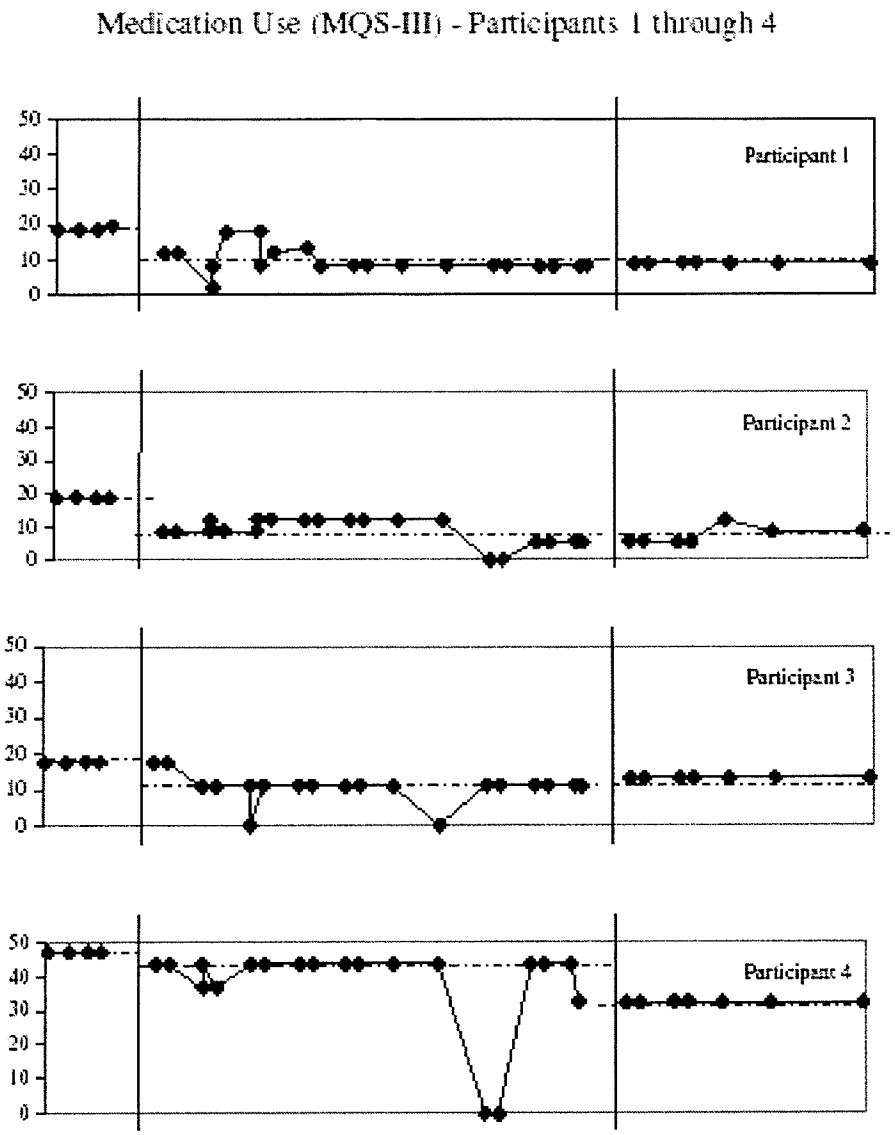
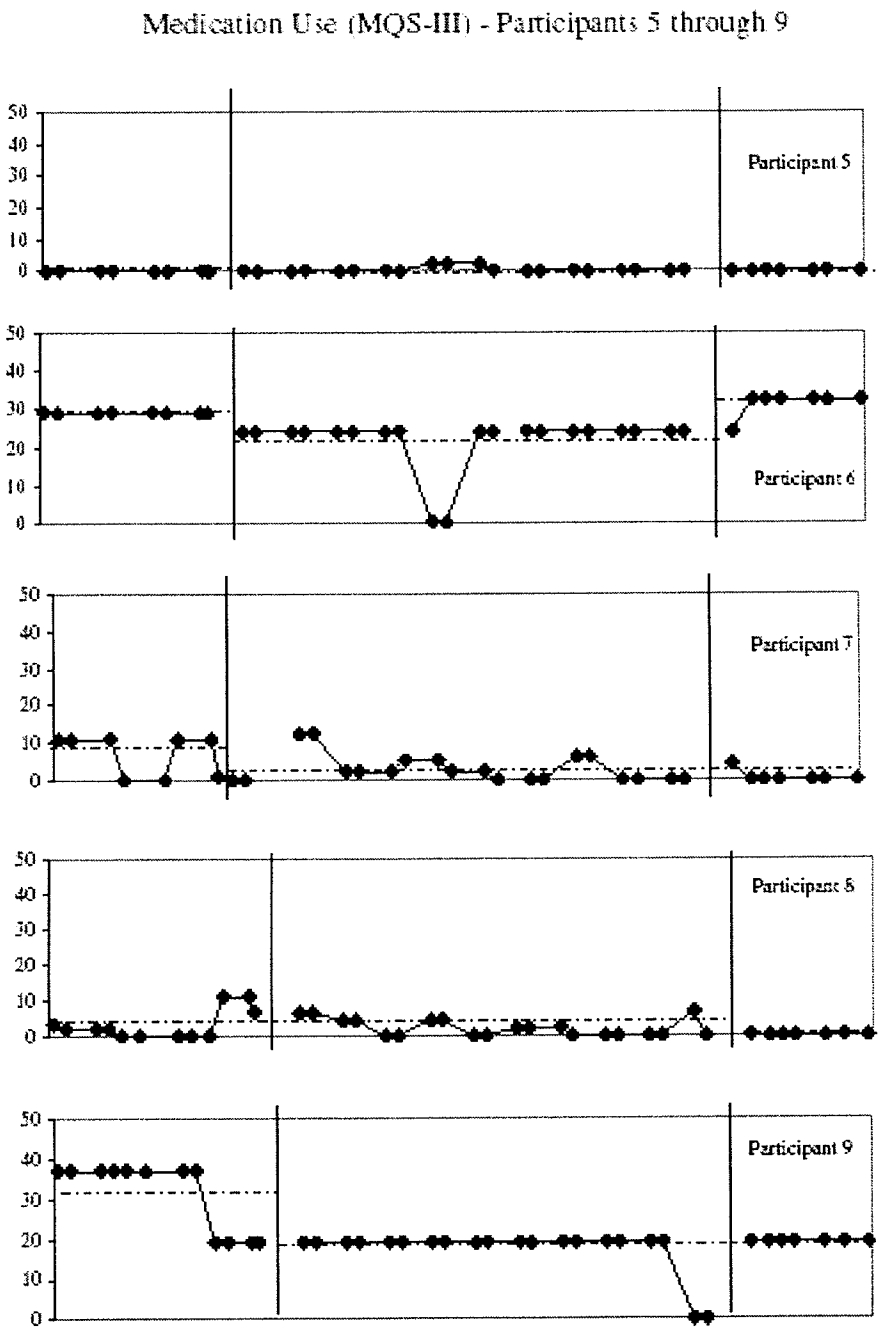

Medication Use (MQS-III) - Participants 1 through 4
Participant 1
Participant 2
Participant 3
Participant 4
50
40
30
20
10
0

Figure 14


Medication Use (MQS-III) - Participants 5 through 9
Participant 5
Participant 6
Participant 7
Participant 8
Participant 9
50
40
30
20
10
0