THE EFFECTS OF A GROUP EXERCISE INTERVENTION IN THE ADJUNCTIVE TREATMENT OF DEPRESSION

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The purpose of this investigation was to evaluate the influence of a 6-week group exercise intervention in the adjunctive treatment of depression. A total of thirty-one subjects were recruited from WPIC's Bellefield Clinic of the Adult Service Line and the surrounding community. Subjects were between the ages of 25 and 60 years, had a diagnosis of depression (dysthymic disorder, major depressive disorder, depressive disorder not otherwise specified, or bipolar disorder) according to the DSM-IV by a licensed therapist, and were enrolled in a standardized outpatient treatment program consisting of antidepressant medication and psychotherapy. Subjects were randomly assigned to either a 6-week exercise group intervention or a social control group (stress coping intervention). Groups were matched for group exposure, meeting for one hour, two nights a week. The IDS-SR was used to assess changes in depressive symptoms as a result of the intervention at 0 and 6-weeks. Additionally, the Q-LES-Q and the Revised UCLA Loneliness Scale were used to assess changes in quality of life and feelings of loneliness, respectively, as a result of the intervention at 0 and 6-weeks. The main hypothesis was that subjects randomized to the group exercise intervention would experience a significant decrease in depressive symptoms, as assessed by the IDS-SR, and a significant increase in quality of life, as assessed by the Q-LES-Q, when compared to the social control group. An additional hypothesis was that subjects in the group exercise intervention and the social control group would experience a significant and equal decrease in feelings of loneliness as assessed by

the Revised UCLA Loneliness Scale. Statistical analysis included separate two-way (group x time) repeated measures ANOVA to determine between and within group mean differences on the IDS-SR, Q-LES-Q, and the Revised UCLA Loneliness Scale. Results indicated that subjects in the group exercise intervention and the social control group experienced a decrease in symptoms of depression, whereas no significant differences in either group for quality of life or feelings of loneliness were found. Results were the same for the intent-to-treat analysis and the non-intent-to-treat analysis. It was concluded that social interaction may have contributed to the positive findings concerning symptoms of depression.

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PREFACE

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This project is dedicated to John, Mom, Dad, Jason, Marion, Troy, Shea, and Josh, my best friends, family, and the subjects of my next study.

1 INTRODUCTION

1.1 INTRODUCTION

Depression is one of the most common and serious psychophysiological illnesses affecting nearly 19 million American adults at least once during their lifetime (Mayo Clinic, 2001). The economic burden of depression is overwhelmingly high, with reported health care costs exceeding $43 billion each year (Greenberg et al., 1993). However, the cost of human suffering is immeasurable. This illness severely disrupts an individual mentally, emotionally, physically, and behaviorally causing pain, suffering, and disability. Additionally, depression is associated with high rates of chronicity, relapse, recurrence, mortality, and morbidity (Hirschfeld et al., 1997).

The term "depression" has been used to describe a variety of altered mood states, which has led to the confusion of its definition. Currently, the American Psychiatric Association (APA) provides the criterion definition of depression and is outlined in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV). The APA defines depression as a *clinical mood disorder* that presents itself in various forms depending upon symptoms, severity, and persistence. The various forms of a mood disorder include depressive disorders (major depressive disorder, dysthymic disorder, and depressive disorders not otherwise specified), bipolar disorder, mood disorder due to a general medical condition, and substance-induced mood disorder. Common symptoms of these disorders include a severely depressed mood; loss of interest or pleasure in hobbies and activities that were once enjoyed; changes in sleep, appetite, and body weight; decreased energy or fatigue; and thoughts of suicide or suicide attempts (APA, 1994).

Treatment is vital in the restoration of psychological and physiological health in those suffering from depression. Traditional treatment includes antidepressant medication, psychotherapy, or a combination of the two. However, the effectiveness, adherence, and costs of such treatments are controversial (Greenberg et al., 1993; Hirschfeld et al., 1997; Blumenthal et al., 1999). As a result, alternative or complimentary forms of treatment have been considered to offset rates of non-responsiveness and non-compliance, as well as to combat the economical burden of standard treatments.

Evidence supporting the use of physical activity, and more specifically exercise, in the treatment of depression is accumulating. Cross-sectional and prospective studies have revealed that an inverse relationship exists between levels of physical activity and depressive symptoms. Stephens (1988), Weyerer (1992), and Hassemen et al. (2000) indicated that symptoms of depression were more prevalent in those who reported little or no physical activity. Likewise, Farmer et al. (1988), Camacho et al. (1991), and Paffenbarger et al. (1994) reported that individuals who engaged in minimal physical activity or led a sedentary lifestyle were at a greater risk for developing depression.

Several experimental studies have also indicated that exercise is more effective than placebo or control conditions or no treatment and is comparable to antidepressant medication or psychotherapy (Greist et al., 1979; McMann and Holmes, 1984; Klein et al., 1985; Fremont and Craighead, 1987; Martinsen et al., 1989; Singh et al. 1997; Blumenthal et al., 1999; Babyak et al., 2000). Dimeo et al. (2001) and Mather et al. (2002) indicated that the addition of exercise to standardized treatment programs also produced a diagnostic improvement in those with depression. Additionally, Doyne et al. (1987) and Martinsen et al. (1989) have shown that depressive symptoms decrease as a result of an exercise intervention, regardless of the mode of

exercise (i.e. aerobic or non-aerobic) and these effects are independent of an increase in aerobic fitness. Recent reviews and meta-analyses (North, McCullagh, and Tran, 1990; Bryne and Bryne, 1993; Martinsen, 1990, 1994; Lawlor and Hopker, 2001) have also indicated that exercise is a viable form of treatment for depression.

Although scientific evidence supporting the use of exercise in the treatment of depression does exist, exercise has not been fully recognized or endorsed by the medical profession (APA, 2000; Pollock, 2001). The lack of recognition may stem from existing skepticism due to design faults in many investigations. Common methodological limitations include failing to document details concerning the exercise intervention, the use of small samples, the use of an inadequate or inappropriate control group, lack of randomized designs, uncontrolled concurrent treatments, inconsistent or inappropriate diagnoses of depression, and the use of non-clinical populations to study clinical depression (North, McCullagh, and Tran, 1990; Bryne and Bryne, 1993; Martinsen, 1994; Lawlor and Hopker, 2001; Buckworth and Dishman, 2002). As a result, the true effectiveness of exercise in the treatment of depression remains debatable. Therefore, it is imperative to conduct further research on the efficacy of exercise in the treatment of depression, addressing the research design limitations of previous investigations.

1.2 RATIONALE

Recently, a number of research studies, using diverse methodologies, have indicated that exercise interventions may be an effective means of treatment for depression (Greist et al., 1979, McMann and Holmes, 1984; Klein et al., 1985; Doyne et al., 1987; Fremont and Craighead, 1987; Farmer et al., 1988; Stevens, 1988; Martinsen et al., 1989; North, McCullagh, and Tran, 1990; Camacho et al., 1991; Weyerer, 1992; Bryne and Bryne, 1993; Martinsen, 1994;

Paffenbarger et al., 1994; Singh et al., 1997; Blumenthal et al., 1999; Babyak et al., 2000; Hassemen et al., 2000; Dimeo et al., 2001, Lawlor and Hopker, 2001; Mather et al., 2002). However, many of these studies have been criticized for methodological flaws (North, McCullagh, and Tran, 1990; Bryne and Bryne, 1993; Martinsen, 1994; Lawlor and Hopker, 2001; Buckworth and Dishman, 2002). Considering the limited amount of quality research provided in the psychological and exercise literature, strong, well-controlled research investigating the effects of an exercise intervention program on depression is warranted. Exercise interventions may prove to be a useful and effective tool in alleviating the psychological and physiological symptoms associated with depression.

1.3 STATEMENT OF THE PROBLEM

The purpose of this study was to investigate the influence of a 6-week group exercise intervention on depressive symptoms, quality of life, and feelings of loneliness in men and women aged 25 to 60 years who have been previously diagnosed with depression (dysthymic disorder, major depressive disorder, depressive disorder not otherwise specified, and bipolar disorder) according to the DSM-IV (APA, 1994).

1.4 HYPOTHESES

The following main hypothesis was tested:

- Subjects assigned to the 6-week group exercise intervention would demonstrate a statistically significant decrease in depressive symptoms, as assessed by the Inventory of Depressive Symptomatology (IDS-SR), when compared to the social control group (stress coping intervention).

1.4.1 SUB-HYPOTHESES

- Subjects assigned to the 6-week group exercise intervention would demonstrate a statistically significant increase in quality of life, as assessed by the Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q (short-form)), when compared to the social control group (stress coping intervention).
- Subjects assigned to the 6-week group exercise intervention and the social control group (stress coping intervention) would demonstrate a statistically significant and equal decrease in feelings of loneliness, as assessed by the Revised UCLA Loneliness Scale.

2 REVIEW OF THE LITERATURE

2.1 INTRODUCTION: PREVALENCE AND SOCIAL IMPACT

Depression is one of the most common and serious psychophysiological disorders occurring in the United States. It is characterized by chronic emotional, cognitive, physical, and behavioral disruptions, as well as high rates of relapse, recurrence, mortality, and morbidity (Hirschfeld et al., 1997). In any given one-year period, depression affects nearly 19 million individuals aged 18 and older. In fact, at least one third of all individuals will suffer a depressive episode during their lifetime (Mayo Clinic, 2001). Although depression can affect anyone regardless of age, gender, race, ethnicity, and societal status, it is most common in women, young adults, the elderly, and those of lower socioeconomic status (Lehtinen et al., 1994).

Depression typically results in high personal, social, and economic costs through suffering and health care provision. It is the leading cause of disability as measured by the YDL's (years lived with disability) and is a major contributor to the global burden of disease. Depression is also the leading cause of alcoholism, drug abuse, and other addictions and is second only to heart disease in causing lost work days. The severity of depressive symptoms has also been compared to diabetes, arthritis, hypertension, back problems, gastrointestinal disorders, and blindness in terms of physical and/or social functioning (Mayo Clinic, 2001). Individuals diagnosed with depression are more likely to develop cardiovascular disease and to die of all causes (Stansfeld et al., 2002). Additionally, it is estimated that the annual economic cost due to depression in the United States is over $43 billion, including $12.4 billion in direct costs for treatment and $31 billion in indirect costs due to premature death, work absenteeism, and reduced productivity (Greenberg et al., 1993). However, the cost of human suffering is immeasurable.

Although depression is an illness that is treatable, it often remains undiagnosed, inappropriately or inadequately treated, or not treated at all. The inability of individuals to recognize symptoms associated with depression, lack of resources, lack of trained providers, and the social stigmatization associated with a mental disorder are common barriers to proper treatment, resulting in only 30% of depressed individuals seeking the attention of a medical professional. In addition, at least 50% of individuals suffering from depression do not receive proper treatment and according to the National Depressive and Manic-Depressive Association (NDMDA), only 10% receive adequate treatment (Hirschfeld et al., 1997). Unfortunately, untreated or inadequately treated depression is the number one cause of suicide in this population. In 1990 approximately 15,000 men and 3,400 women committed suicide as a result of depression (Greenberg et al., 1993).

2.2 DEFINING DEPRESSION

Current psychological and exercise literature is void of a universal definition of depression. Depression is often used to describe a variety of psychophysiological states differing in severity, symptoms, causes, and persistence. Depression has been used to describe a *general mood state* (normal, periodic feelings of hopelessness, sadness, low-energy, and/or the inability to experience pleasure), a *secondary psychological disorder* (depression resulting from another disease or health condition, such as an eating disorder, cardiovascular disease, cancer, or other medical conditions), as well as a *primary psychological disorder* (a clinical diagnosis or mental illness often referred to as a mood disorder). This lack of uniformity has resulted in confusion in the diagnosis, classification, and measurement of depression.

Currently, the criterion definition of depression is presented in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV). The DSM-IV is the current

reference used by mental health professionals to define, identify, and diagnose mental illnesses. Depression is an illness much different than the normal mood shifts experienced by most individuals. It is a *clinical* psychosomatic disorder that severely disrupts an individual's emotions, thought processes, behavior, and physical health. The DSM-IV classifies depression as a *mood disorder*, presenting itself in various forms depending upon the number of symptoms, severity, and persistence. The various forms of depression are categorized into the following main mood disorders:

- Depressive Disorders ("Unipolar Depression")
- Bipolar Disorder
- Mood Disorder Due To A General Medical Condition
- Substance-Induced Mood Disorder (APA, 1994)

2.2.1 DEPRESSIVE DISORDERS

Depressive disorders are the most common form of the mood disorders and are divided into three subtypes: 1) Major Depressive Disorder 2) Dysthymic Disorder and 3) Depressive Disorders Not Otherwise Specified. Those suffering with a depressive disorder often experience one or more of the following symptoms:

- Severe, persistent depressed mood
- A loss of interest or pleasure in normal activities
- Significant weight loss or gain without dieting (i.e. a change of more than 5% of body weight in a month)
- Increase or decrease in appetite
- Insomnia or hypersomnia
- Psychomotor agitation or retardation

- Fatigue or a decrease in energy
- Feelings of lethargy or restlessness
- Feelings of guilt or worthlessness
- Difficulty thinking or concentrating
- Recurrent thoughts of death or suicide (APA, 1994)

Major Depressive Disorder (MDD) is the most common form of the depressive disorders and is characterized by one or more major depressive episode. A major depressive episode is defined as the exhibition of a severely depressed mood or the loss of interest in normal activities accompanied by at least four of the previously mentioned symptoms persisting nearly every day over a two-week period. Individuals may experience an isolated episode of major depression or it may be reoccurring, with the likelihood of reoccurrence increasing with each episode. At least 60% of individuals suffering from an isolated episode will experience a second one. The reoccurrence rate increases to 70% and 90% for third and fourth isolated episodes, respectively. Reoccurring depressive episodes may be separated by weeks, months, or years and tend to follow a severe psychosocial stressor, such as the death of a loved one or divorce (APA, 1994).

MDD typically occurs in individuals between the ages of 25 and 44, with the average onset in the mid-20's and is more common in women (5% to 9%) than in men (2% to 3%). This disorder typically affects those who have a genetic predisposition, as reports have indicated that individuals with a parent or sibling who has been diagnosed with major depressive disorder may be 1.5 to 3 times more likely to develop the condition than those who do not. In addition, certain medical conditions may contribute to the development of MDD. Approximately, 20%-25% of individuals diagnosed with medical conditions, such as cancer, diabetes, and heart disease, will

develop major depressive disorder sometime during the course of their illness, resulting in a less favorable prognosis (APA, 1994).

Individuals with MDD experience increased physical pain and illness, as well as decreased physical and social function. Unfortunately, MDD is associated with a high mortality rate with nearly 15% of individuals diagnosed committing suicide (APA, 1994).

Dysthymic Disorder is a chronic form of mild depression lasting most days for at least two years. The primary symptom of dysthymia is a feeling of sadness, but is also accompanied by at least two of the aforementioned symptoms. These symptoms have a negative impact on an individual's ability to function in everyday life, often resulting in social withdrawal and decreased productivity. Periods of dysthymia may alternate with symptom-free intervals lasting no longer than two months (APA, 1994).

Approximately 3% of the population will be affected by dysthymia at any given point. Dysthymia has an early onset (i.e. childhood, adolescence, or early adult life), with females 2-3 times more likely to be affected than males. Individuals with a first-degree relative who have been diagnosed with MDD are at increased risk for developing dysthymia. Unfortunately, individuals who suffer with this disorder are also at an increased risk for developing episodes of MDD. It has been reported that 10% of patients will go on to develop MDD, a condition known as "double depression" (APA, 1994).

Depressive Disorder Not Otherwise Specified is a depressive disorder characterized by common depression symptoms, but does not meet the diagnostic criteria for MDD or dysthymia. Common forms of Depressive Disorder Not Otherwise Specified include Premenstrual Dysphoric Disorder, Minor Depressive Disorder, and Recurrent Brief Depressive Disorder (APA, 1994).

2.2.2 BIPOLAR DISORDER

Bipolar Disorder, also known as manic-depressive disorder, is characterized by recurring cycles of depression and mania. Unlike depressive episodes, a manic episode is marked by distinct periods of abnormally and persistently elevated mood (euphoria) or irritability, accompanied by at least three (four if the persistent mood is irritability) of the following symptoms:

- Overly-inflated self esteem
- Decreased need for sleep
- Increased talkativeness
- Racing thoughts
- Distractibility
- Increased goal-oriented activity or physical agitation
- Excessive involvement in pleasurable activities that have a high potential for painful consequences

Depression/manic cycles may continue for days, weeks, or months depending on the individual. Most individuals with bipolar disorder will return to a normal level of functioning between phases of depression and mania, however, some continue to experience problems with mood stability and social and occupational functioning (APA, 1994).

Bipolar disorder equally affects males and females with the average onset at 20 years of age. It has been contended that a genetic predisposition may exist, as approximately 80%-90% of individuals with bipolar disorder are related to an individual with some form of a mood disorder. Bipolar disorder is recurrent in 90% of patients and is associated with major life disruptions (APA, 1994). Unfortunately, bipolar disorder is potentially lethal with

approximately 25% attempting suicide and 11-19% succumbing to suicide (Leverich et al., 2001). Bipolar Disorder includes three subtypes:

- ***Bipolar I Disorder*** - includes one or more episodes of Major Depression, accompanied with at least one manic episode.
- ***Bipolar II Disorder*** - characterized by one or more episodes of Major Depression, as well as at least one hypomanic episode, a mild or toned down elation.
- ***Cyclothymic Disorder*** - chronic, milder form of bipolar disorder characterized by fluctuating mood disturbances (hypomania and depressive symptoms) (APA, 1994).

2.2.3 MOOD DISORDER DUE TO A GENERAL MEDICAL CONDITION/SUBSTANCE-INDUCED MOOD DISORDER

Mood Disorder Due to a General Medical Condition and Substance-Induced Mood Disorder are defined and diagnosed based on their etiology. A Mood Disorder Due to a General Medical Condition occurs as a direct result of physiological effects of a general medical condition, such as degenerative neurological conditions (i.e. Parkinson's disease, Huntington's disease), cerebrovascular disease, metabolic complications (i.e. thyroid conditions, vitamin B_{12} deficiency), autoimmune diseases (i.e. lupus), and certain cancers. Substance-Induced Mood Disorder results from the physiological effect of a substance such as drugs, alcohol, or medication. Both disorders are characterized by a significant and persistent depressed mood, irritability, diminished interest or pleasure in normal activities, or elevated, expansive, or irritable mood (typically occurring during withdrawal or intoxication of a substance for those affected by substance-induced mood disorder). These symptoms most always cause significant distress and impairment in normal everyday activities (APA, 1994).

2.3 CAUSES AND RISK FACTORS OF DEPRESSION

Although, the direct cause of depression has not been clearly identified, it appears that depression results from a complex interaction of biological, genetic, environmental, psychological, and medical factors (North, McCullagh, Tran, 1990; Buckworth and Dishman, 2002). Additionally, numerous risk factors that predispose a person to develop such an illness have been postulated. Common risk factors include gender, marital factors, age, socioeconomic status, and physical activity level (Mayo Clinic, 2001).

Of particular interest is the influence physical activity may have on the development of depression. Physical activity is defined as bodily movement that is produced by the contraction of skeletal muscle that substantially increases energy expenditure. Subtypes of physical activity include activities of daily living, such as occupational and household activities and leisure activities, including recreation and exercise (ACSM, 2000). Cross-sectional and prospective research studies have shown strong correlations between depression and physical activity levels, indicating a lack of regular physical activity may be a contributing factor in the etiology of depression.

Stephens (1988) conducted a cross-sectional age-gender discriminate analysis assessing the relationship between physical activity levels and mental health on four United States and Canadian household samples over a ten year period. The authors concluded that mental health, defined as positive mood, general well-being, and infrequent symptoms of anxiety and depression, was positively correlated with higher levels of physical activity. These results were independent of socioeconomic status and physical health and were stronger for women and persons aged 40 years and older. Additionally, when asked for reasons for participating in physical activity, 62% of adults responded “to feel better mentally and physically.” This

response ranked first in importance followed by other health-related reasons, such as weight control.

Likewise, Weyerer (1992) examined the influence of activity levels on mental health in 1,536 Germans aged 15 and older. A cross-sectional analysis indicated that subjects who were not physically active were 3.15 times more likely to experience symptoms of depression compared to those who engaged in regular physical activity. This inverse relation between activity and depression was strongest in women, older individuals, those of low socioeconomic status, and those with a somatic disorder. This study, however, did not report baseline levels of activity as a risk factor for depression at a five year follow-up.

Similarly, Hassemen et al. (2000) conducted a cross-sectional study to explore the association between physical activity and psychological well-being in a Finland based population. A total of 3,404 individuals (1856 women and 1547 men) divided into four age groups (25-34, 35-44, 45-54, and 55-64) completed self-report questionnaires concerning physical activity and depressive symptoms. The authors concluded that those participating in regular physical activity experienced less depressive symptoms compared to those who were less active or sedentary. It was also noteworthy that individuals who were unable to participate in physical activity due to an illness or handicap reported the most symptoms of depression.

Although a number of these cross-sectional studies have shown that depressive symptoms occur more frequently among those who participate in little or no physical activity, a causal relationship has yet to be determined. It remains unclear whether physical inactivity contributes to symptoms of depression or if symptoms of depression lead to inactivity. However, several prospective studies have been conducted to determine whether physical activity levels can

predict the development of depression. These prospective studies may be a better indicator of the relationship between physical activity and depression (Dunn et al., 2001).

Farmer et al. (1988) conducted a prospective study (NHANES I Study) examining the relationship between self-reported physical activity and symptoms of depression in 1,900 healthy subjects between the ages of 25-77 years. Results indicated that baseline physical activity levels were a predictor of depressive symptoms in Caucasian women at the eight year follow-up. Specifically, women who reported little or no physical activity at baseline were more likely to report depressive symptoms at follow-up. In addition, physically inactive Caucasian men at baseline were 12 times more likely to be depressed after eight years when compared to men who were initially depressed, but later increased their physical activity level. These findings were independent of age, education, employment, socioeconomic status, and other chronic illnesses.

Camacho et al. (The Alameda County Study) (1991) examined survey responses concerning physical activity and depression for nearly 5,000 non-depressed adults in 1965, 1974, and 1983. The outcome of this prospective study indicated that individuals who were not depressed or physically active in 1965 had a 70% increased risk for depression at the 1974 follow-up when compared to those who were initially active. Results were independent of socioeconomic status, physical health, social supports, and other health habits. Additionally, associations between 1965-1974 changes in activity level and depression at the 1983 follow-up suggested that the risk of depression can be lowered by increased levels of activity.

In a more recent prospective study, Paffenbarger et al. (1994) examined physical activity habits and incidence rates of physician-diagnosed depression from questionnaires returned by Harvard alumni who had entered college between 1916 and 1950. During a 23-27 year follow-up period, results indicated that men who expended 1,000-2,499 kilocalories per week by

walking, stair climbing, or participating in sport were 17% less likely to develop depression than those less active. Additionally, men who expended 2,500 or more kilocalories per week had a 28% less likelihood of developing depression then men who expended less than 1,000 kilocalories per week. These findings also demonstrated a dose-response relationship, indicating that higher levels of physical activity may result in a greater decrease in the risk for depression than lower levels of physical activity.

2.4 STANDARD TREATMENT OF DEPRESSION

Treatment of depression is crucial in restoring normal psychological and physical health. Currently, the most common forms of treatment include antidepressant medication, psychotherapy, or a combination of both (Mayo Clinic, 2001). Although effective, these treatment forms are not successful or desirable for all patients (Blumenthal et al., 1999; Hirschfeld et al., 1997). It has been estimated that nearly 30%-35% of individuals do not respond to antidepressant medication. In addition, antidepressant medications often result in unwanted side-effects (nausea, diarrhea, insomnia, nervousness, agitation, anxiety, constipation, blurred vision, urinary retention, postural hypotension, and weight gain), adversely affecting quality of life and further reducing compliance (Blumenthal et al., 1999). In fact, research has shown that between 20%-59% of patients in primary care settings stop taking antidepressants within three weeks of the drugs being prescribed (Lawlor and Hopker, 2001). Moreover, the effectiveness of antidepressants is individual, as some patients may exhibit an improvement in symptoms with short-term antidepressant use, however a significant risk for relapse within one year of terminating treatment does exist (Blumenthal et al., 1999). Furthermore, the annual costs associated with traditional forms of treatment may prove to be disconcerting for out-of-pocket expenders and health insurance companies. It is estimated that the annual economic cost of out-

patient care/partial care and pharmaceutical expenses are $2.9 billion and $1.175 billion, respectively (Greenberg et al., 1993). Alternative or complimentary forms of treatment must be considered in order to assist in the effective management and recovery of depression, as well as combat the economical burden associated with traditional forms of treatment.

2.5 THE USE OF PHYSICAL ACTIVITY IN THE TREATMENT OF DEPRESSION

Recently, the use of physical activity, and more specifically exercise, has received considerable attention as a surrogate or adjunct treatment for depression. Exercise is defined as a subset of physical activity consisting of planned, structured, repetitive bodily movements with the purpose of improving or maintaining one or more components of physical fitness or health (ACSM, 2000). Most experimental studies, meta-analyses, and research reviews, using diverse populations, diagnoses of depression, and methodologies have indicated that exercise is effective in the alleviation of depression. It appears that exercise is more effective than placebo control conditions or no treatment conditions and is comparable to antidepressant medication or psychotherapy (Greist et al., 1979; McMann and Holmes, 1984; Klein et al., 1985; Fremont and Craighead, 1987; Martinsen et al., 1989; Singh et al., 1997; Blumenthal et al., 1999; Babyak et al., 2000). Exercise has also been shown to produce a diagnostic improvement for those with depression when used in combination with standard treatment programs (Dimeo et al., 2001 and Mather et al., 2002). Additionally, studies have found both, *aerobic* (defined as any activity that involves the rhythmic interaction of large muscle groups over prolonged periods, such as running (ACSM, 2000)) and *non-aerobic* (such as resistance exercise, defined as skeletal muscle contraction against a sub-maximal resistance, such as lifting weights (ACSM, 2000)) exercise to be useful in reducing symptoms of depression. Reductions in depressive symptoms also seem to occur independent of changes in aerobic fitness (Doyne et al., 1987; Martinsen et al., 1989).

2.5.1 EXERCISE VS. NO TREATMENT, PLACEBO TREATMENT, OR STANDARD TREATMENT

Several studies have evaluated the effectiveness of exercise compared to no treatment in alleviating symptoms of depression, while other investigations have compared exercise to placebo or traditional forms of treatment. Martinsen et al. (1989) asked depressed patients to evaluate the effectiveness of exercise compared to other forms of treatment. Subjects in the training group ranked exercise as "the therapeutic element that had helped them most, prior to individual psychotherapy." Singh et al. (1997) randomly assigned 32 men and women with a mean age of 71 years to a 10-week high intensity resistance exercise group (resistance exercises performed three times a week) or an education control group. Subjects were diagnosed with minor or major depressive disorder or dysthmic disorder, based on the DSM-IV. Results indicated that subjects assigned to the resistance exercise group significantly reduced symptoms of depression, as assessed by the Beck Depression Inventory, when compared to the education control group.

McMann and Holmes (1984) randomly assigned 43 depressed undergraduate women to a 10-week aerobic exercise treatment condition (participated in aerobic dance exercise class for one hour two times a week and were encouraged to exercise outside of class), a placebo treatment condition (relaxation exercises), or a no-treatment condition. Subjects in the aerobic exercise treatment condition demonstrated a greater decrease in depressive symptoms, as assessed by the Beck Depression Inventory, when compared to the placebo condition or the no-treatment condition.

Greist et al. (1979) conducted one of the first studies using an experimental design to investigate the effects of exercise on depression. Subjects included 28 males and females

between the ages of 18 and 30 who scored above the 50th percentile on the Symptom Checklist-90 and were diagnosed with minor depression as determined by the Research Diagnostic Criteria. Subjects were randomly assigned to a either a running group (1 hour of running, 3-4 days per week) or one of two types of individual psychotherapy (10-session time limited or time unlimited). The authors concluded that after 10-weeks, the running intervention was as effective as the psychotherapy in assuaging symptoms of depression.

Klein et al. (1985) randomly assigned 74 males and females, diagnosed with unipolar depression according to the Research Diagnostic Criteria, to one of three 12-week treatment groups: 1) running therapy (two 45-minute sessions/week) 2) meditation-relaxation therapy (weekly two-hour group sessions consisting of breathing and yoga-based exercises) or 3) group therapy (weekly two-hour sessions including interpersonal and cognitive therapy). Depressive symptoms, as assessed by the Symptom Checklist, significantly decreased within each treatment group. The authors concluded that exercise was an effective treatment option for those with depression.

Fremont and Craighead (1987) examined the separate and combined effects of cognitive therapy and aerobic exercise in the treatment of dysphoric moods (mild to moderate depression). A total of 49 individuals aged 19-62 years were randomly assigned to a supervised running group (3 times per week of 20 minutes of continuous walking or jogging), cognitive therapy group (individual therapy session meeting one time a week for one hour), or combination of exercise and therapy group. After 10 weeks, all groups revealed a significant decrease in depressive symptoms, as assessed by the Beck Depression Inventory, with no significant difference between groups. These results indicated that exercise was equally effective as psychotherapy, however, no additional benefit was observed when treatments were combined.

Recently, Blumenthal et al. (1999) conducted a well-controlled clinical trial examining 156 men and women aged 50 years and older who were diagnosed with MDD. Subjects were randomly assigned to one of three treatment groups: 1) group walking or jogging (3 times per week at 70% to 85% of heart rate reserve for 30 continuous minutes) 2) antidepressant medication (setraline – a selective serotonin reuptake inhibitor) or 3) a combination of exercise and medication. Depressive symptoms were assessed using the Hamilton Rating Scale for Depression (HRSD) and the Beck Depression Inventory. After 16 weeks of treatment, all three groups revealed statistically and clinically (no longer met the DSM-IV criteria for MDD) significant reductions in symptoms of depression. Subjects receiving medication alone, however, appeared to have the fastest response to treatment. Based on these findings, it was concluded that an exercise program was as effective as other traditional forms of treatment and, therefore, should be considered an alternative to antidepressants.

Interestingly, Babyak et al. (2000) conducted a follow-up study to the previously mentioned Blumenthal study. Six months after completion of the treatment intervention, the authors found that patients who reported continued participation in regular aerobic exercise were more likely to recover from depression when compared to those in the medication treatment group. Additionally, subjects who received a combination of exercise and antidepressant medication were no more likely to be categorized as partially (no DSM-IV diagnosis for MDD and a HRSD score greater than 7 but less than 15) or fully (no DSM-IV diagnosis for MDD and a HRSD score less than 8 for greater than 6 months) recovered than were patients in the antidepressant group. Moreover, only 8% of remitted patients in the exercise group relapsed compared to 38% in the antidepressant group and 31% in the combined group.

2.5.2 EXERCISE AS AN ADJUNCT TO STANDARD TREATMENT

The use of exercise as an adjunct to traditional forms of treatment has also been studied. Mather et al. (2002) used a randomized controlled study to determine if exercise was an effective addition to antidepressant therapy in reducing symptoms of depression in older individuals with poorly responsive depressive disorder. Eighty-six individuals aged 53 to 78 years were randomly assigned to either an exercise group (a 45 minute exercise group consisting of endurance, muscular strength, and flexibility exercises, 2 times per week) or a non-exercise social control group (i.e. health education talks, 2 times per week). Symptoms of depression were assessed using the Hamilton Rating Scale for Depression (HRSD), Geriatric Depression Scale (GDS), Clinical Global Impression (CGI), and the Patient Global Impression (PGI) at baseline and 10 weeks. The primary outcome of interest in this study was the proportion of subjects achieving a response, defined as a greater than or equal to a 30% reduction in depressive symptoms. Results indicated that at 10-weeks a higher proportion of the exercise group (55%) experienced a greater than 30% decline in depressive symptoms according to the HRSD as compared to the control group (33%). The authors concluded that although these results were modest, exercise may offer a useful supplement to antidepressant therapy and should be encouraged for patients with poorly responsive depressive disorder.

Dimeo et al. (2001) conducted a pilot study examining the effects of an aerobic exercise program on patients with MDD. A total of 12 patients between the ages of 20-65 years participated. Subjects were currently enrolled in traditional forms of treatment (psychotropic medication, psychotherapy, or behavioral therapy), but reported no changes in symptoms during the six weeks preceding the exercise intervention. The 10-day exercise intervention consisted of treadmill walking for 30 continuous minutes. Results indicated a clinically (defined as a

reduction in depressive symptoms by 50% or more or a final score of 10 or less on the Hamilton Rating Scale for Depression) and statistically significant reduction in depression symptoms as assessed using the Hamilton Rating Scale for Depression and the Scale for Self Assessment of Depression. It was concluded that the aerobic exercise intervention produced a diagnostic improvement for patients with MDD.

2.5.3 AEROBIC VS. NON-AEROBIC EXERCISE

Aerobic and non-aerobic exercise has been compared for their ability to reduce symptoms of depression. Doyne et al. (1987) compared the effectiveness of running and resistance training in the treatment of clinical depression, according to the Research Diagnostic Criteria, in 40 women aged 18-35 years. Subjects were randomly assigned to an eight week running group (4 individual exercise sessions per week with exercise intensity set at 80% of estimated work capacity), weight lifting group (4 individual exercise sessions per week consisting of a 10-station program with exercise intensity set at 50%-60% of estimated heart rate maximum), or a wait-listed control group. Depression was assessed using the Beck Depression Inventory, Hamilton Rating Scale for Depression, and Lubin's Depression Adjective Check List. The results of this study revealed that both exercise groups equally reduced depressive symptoms, whereas the control group exhibited no change in symptoms. The authors concluded that both types of exercise were successful in the treatment of depression and that participation in physical activity was more important than type of activity. Additionally, the reduction in depression was independent of changes in aerobic capacity, indicating an improved aerobic fitness level was not necessary to reduce symptoms of depression.

Martinsen et al. (1989) also examined the effects of aerobic exercise versus non-aerobic exercise in the treatment of clinical depression. Ninety-nine subjects (mean age 41) were

randomly assigned to an aerobic exercise group consisting of walking and jogging at 70% of VO_{2max} or to a non-aerobic group consisting of resistance, flexibility, and relaxation exercises. Each exercise session lasted one hour and met 3 times a week for 8 weeks. Post-treatment results revealed that both groups had a significant and comparable decrease in symptoms of depression as revealed by the Beck Depression Inventory and the Montgomery and Asberg Depression Rating Scale. These results occurred although the aerobic group exhibited significant improvements in aerobic fitness compared to no change in aerobic fitness for those in the non-aerobic group. The authors concluded that both aerobic and non-aerobic exercise was effective in the treatment of depression.

2.5.4 REVIEWS AND META-ANALYSES

Several reviews and meta-analyses have also supported the claim that exercise is advantageous in the treatment of depression. Bryne and Bryne (1993) found that 90% of studies examining the effects of exercise on depression revealed that exercise was an effective antidepressant (review included clinical and non-clinical studies). Martinsen (1990, 1994) authored two reviews of studies examining the effects of exercise on depressed individuals and concluded that exercise can be a useful adjunct to traditional treatments.

North, McCullagh, and Tran (1990) produced a meta-analysis looking at 80 cross-sectional or longitudinal studies (included clinical and non-clinical populations). The results provided positive support for the use of exercise in the treatment of depression. Specifically, acute and chronic exercise significantly decreased symptoms of depression. Although, symptoms of depression decreased regardless of gender, age, or health status, these effects were greatest for those who were initially physically or psychologically unhealthy. In addition,

aerobic and resistance exercise were equally effective in reducing symptoms of depression and were as effective as psychotherapy.

Lawlor and Hopker (2001) conducted a meta-analysis examining 14 randomized controlled trials and found that depressed individuals assigned to an exercise treatment group had a -1.1 SD (95% CI: -1.5 to -0.6) reduction in symptoms when compared to those who received no treatment. Calculated pooled differences for the mean scores on the Beck Depression Inventory (BDI) revealed that those who exercised scored 7.3 points less on the BDI when compared to those who did not exercise. Additionally, the effects of exercise were similar to the effects of psychotherapy (-0.3 SD, 95% CI -0.7 to 0.1).

2.6 MECHANISMS OF THE ANTIDEPRESSANT EFFECT OF EXERCISE

Several theoretical mechanisms explaining the antidepressant effect of exercise have been proposed. Previous research has focused on physiological/biochemical mechanisms, such as the cardiovascular fitness hypothesis, amine hypothesis, and the endorphin hypothesis. Psychological mechanisms have also been theorized, including the social interaction hypothesis, time-out/distraction hypothesis, and cognitive-behavioral hypothesis. However, no single explanation completely describes the antidepressant effect of exercise, as it appears to be influenced by a multifaceted interaction of physiological/biological and psychological events (North, McCullagh, and Tran, 1990; Buckworth and Dishman, 2002)).

2.7 RESEARCH LIMITATIONS

Although evidence supporting the use of exercise in the treatment of depression is accumulating, it is not fully accepted and/or endorsed (Pollock, 2001). The most recent publication of the Practice Guidelines for MDD in Adults does not include the use of exercise in the treatment of depression and as a result, the number of therapists that promote exercise is

limited (APA, 2000). Reasons for this restraint may be related to the methodological limitations of previous research. Reviews and meta-analyses have criticized most studies of exercise and depression for their use of small samples, lack of adequate control groups, lack of randomized designs, uncontrolled concurrent treatments, inconsistent or inappropriate diagnoses of depression, and the use of non-clinical populations to study clinical depression. Additionally, most studies fail to report details of the exercise intervention, making duplication difficult. Although, several researchers have attempted to improve upon these methodological constraints, the true antidepressant effect of exercise remains questionable. As a result, methodologically sound exercise intervention studies are warranted (North, McCullagh, and Tran, 1990; Bryne and Bryne, 1993; Martinsen, 1990, 1994; Lawlor and Hopker, 2001; Buckworth and Dishman, 2002).

2.8 CLINICAL LIMITATIONS

Despite favorable effects of exercise on depression, relatively few depressed individuals begin and maintain an exercise program (Pollock, 2001). Recent reports have indicated that approximately 60% of adults are physically inactive or irregularly active during leisure time and this percentage may be higher in those with depression (Pate et al., 1995). Martinsen et al. (1989, 1990) revealed that individuals with depression are less physically active and more deconditioned than non-depressed individuals. Additionally, research has shown that 50% of individuals who begin an exercise program quit within six months, independent of the activity chosen. These adherence rates have been shown to be similar or higher in the depressed population. In fact, exercise adherence rates have been shown to be dramatically less than that for antidepressant medication. Common symptoms of depression, such as fatigue, lack of energy, psychomotor retardation, may pose as barriers to participating in an exercise program (Pollock, 2001). Therefore, careful consideration must be made in developing the exercise

prescription, paying close attention to format and exercise frequency, intensity, duration, and mode.

2.9 SUMMARY OF THE LITERATURE

In summary, depression is a serious psychophysiological disorder characterized by significant personal and economical burdens. Traditional forms of treatment include antidepressant medication and/or psychotherapy, however, these forms of treatment may not be an effective means for reducing symptoms of depression in all patients (Hirshfeld et al., 1997; Blumenthal et al., 1999). Additionally, antidepressants and psychotherapy may not be cost-effective, as the annual economical cost of treatment remains overwhelmingly high (Greenberg et al., 1993).

Considerable supporting evidence has suggested that exercise may be an effective alternative or adjunct form of therapy in the treatment of depression. Cross-sectional and prospective studies have shown that an inverse relationship exists between physical activity levels and depressive symptoms (Farmer et al., 1988; Stephens, 1988; Camacho et al., 1991; Weyerer, 1992; Paffenbarger et al., 1994; Hassemen et al., 2000). It also appears that exercise is more effective than no treatment while not significantly different than other forms of treatment, including antidepressants and psychotherapy (Greist et al., 1979, McMann and Holmes, 1984; Klein et al., 1985; Doyne et al., 1987; Fremont and Craighead, 1987; Farmer et al., 1988; Stevens, 1988; Martinsen et al., 1989; North, McCullagh, and Tran, 1990; Camacho et al., 1991; Weyerer, 1992; Bryne and Bryne, 1993; Martinsen, 1994; Paffenbarger et al., 1994; Singh et al., 1997; Blumenthal et al., 1999; Babyak et al., 2000; Hassemen et al., 2000; Lawlor and Hopker, 2001). Moreover, the addition of exercise to standard treatment programs has also produced a diagnostic improvement in those with depression (Dimeo et al., 2001 and Mather et al., 2002). A

few studies have also indicated a positive relationship between exercise and depression regardless of type of exercise performed or changes in aerobic fitness level (Doyne et al., 1987; Martinsen et al., 1989).

Previous research examining the effects of exercise on depressive symptoms is plagued with methodological errors, resulting in uncertainty with respect to the antidepressant effect of exercise. Therefore, well designed studies evaluating the influence of exercise on depression are warranted. It is hopeful that future research will demonstrate that exercise is an essential and cost-effective component in the treatment of depression.

3 METHODS

3.1 OBJECTIVES AND SPECIFIC AIMS

The purpose of this study was to investigate the influence of a 6-week group exercise intervention on depressive symptoms, quality of life, and feelings of loneliness in men and women aged 25 to 60 years who had a current diagnosis of depression (dysthymic disorder, major depressive disorder, depressive disorder not otherwise specified, or bipolar disorder) according to the DSM-IV and who were currently enrolled in a traditional depression treatment program consisting of antidepressant medication and psychotherapy. Specifically, this study prospectively assessed changes in depressive symptoms, quality of life, and feelings of loneliness subsequent to a 6-week group exercise intervention and compared to a social control group (stress coping intervention). It was hypothesized that 1) individuals assigned to the 6-week group exercise intervention would experience a statistically significant decrease in depressive symptoms (assessed by IDS-SR) when compared to the social control group (stress coping intervention), 2) individuals assigned to the 6-week group exercise intervention would experience a statistically significant increase in quality of life (assessed by Q-LES-Q (short-form)) when compared to the social control group (stress coping intervention), and 3) subjects assigned to the 6-week group exercise intervention and the social control group (stress coping intervention) would demonstrate a statistically significant and equal decrease in feelings of loneliness, as assessed by the Revised UCLA Loneliness Scale.

3.2 RESEARCH DESIGN

This study employed a randomized clinical trial to examine the effects of a 6-week group exercise intervention on depressive symptoms, quality of life, and feelings of loneliness in individuals with a current diagnosis of depression and who were currently enrolled in a traditional treatment program consisting of antidepressant medication and psychotherapy.

Subjects attended a total of 14 visits, including initial screening (1), psychological and physical assessments (1), and intervention sessions (12). Written consent was obtained prior to collecting any subject information in accordance with the University of Pittsburgh's Institutional Review Board. Screening procedures took place prior to the start of the intervention at the Western Psychiatric Institute and Clinic's Bellefield Clinic of the Adult Service Line and was administered by the principal investigator. Screening procedures consisted of the Physical Activity Readiness Questionnaire (PAR-Q), medical history, and the Inventory of Depressive Symptomatology – Self Report (IDS-SR) and required approximately 60 minutes to complete.

Experimental procedures, including physical and psychological assessments, were also conducted prior to the start of the intervention and were conducted at the University of Pittsburgh's Center for Exercise and Health Fitness Research. Psychological assessments took place prior to the start of the intervention and at the end of the 6-week intervention. Psychological assessments included the IDS-SR, Quality of Life and Enjoyment Satisfaction Questionnaire (Q-LES-Q (short-form)), the Revised UCLA Loneliness Scale and took approximately 30 minutes to complete. The primary investigator was blinded to the results of the psychological assessments until the completion of the study. The physical assessments were also conducted prior to the start of the intervention and were administered by the principal investigator. The physical assessments included the administration of a physical activity questionnaire, measurement of body height and weight, resting heart rate and blood pressure,

cardiorespiratory fitness, and muscular strength. The physical assessments took approximately 60 minutes to complete.

Following the screening and initial experimental procedures, subjects were randomly assigned to either the group exercise intervention or the social control group (stress coping intervention). All subjects were required to attend two, one hour group sessions per week for a total of 6-weeks. Exercise sessions took place on Monday and Wednesday evenings from 6:00 to 7:00 pm at Three Rivers Sports Medicine and Fitness Center. The stress coping sessions took place on Tuesday and Thursday evenings from 6:00 to 7:00 pm at the UPMC Comprehensive Heart Center.

3.3 EXPERIMENTAL VARIABLES

3.3.1 DESCRIPTIVE VARIABLES

Descriptive data, including age, gender, duration of diagnosis, severity of illness, ethnicity, marital status, education level, occupation, and socio-economic status were collected on all subjects. Additionally, physical characteristics, such as body height and weight, resting heart rate and blood pressure, cardiorespiratory fitness, muscular strength, as well as baseline physical activity levels were collected prior to the intervention. A description of testing procedures for the aforementioned physical characteristics is provided in later sections.

3.3.2 PRIMARY DEPENDENT VARIABLE

The dependent variable for this study was depressive symptoms and was assessed using the IDS-SR (APPENDIX A). A description of this questionnaire is provided in subsequent sections.

3.3.3 SECONDARY DEPENDENT VARIABLES

Quality of life and feelings of loneliness were used as secondary dependent variables. Quality of life was assessed using the Q-LES-Q (short-form) (APPENDIX B) and feelings of loneliness were assessed using the Revised UCLA Loneliness Scale (APPENDIX C). A description of these questionnaires is provided in subsequent sections.

3.3.4 INDEPENDENT VARIABLES

The independent variable was group assignment. Subjects were assigned to either a group exercise intervention or a social control group (stress coping intervention). A description of these interventions is provided in later sections.

3.4 SUBJECTS

Thirty-one males and females diagnosed with clinical depression (dysthymic disorder, major depressive disorder, depressive disorder not otherwise specified, or bipolar disorder), according to the DSM-IV (APA, 1994), were recruited from the Western Psychiatric Institute and Clinic's Bellefield Clinic of the Adult Service Line, as well as from area hospitals, churches, and depression support group facilities. Subjects were diagnosed by and under the care of a licensed psychologist, psychiatrist, or therapist in an outpatient treatment program.

3.4.1 INCLUSION CRITERIA

- Male or female aged 25-60 years
- A current diagnosis of depression, according to the DSM-IV and confirmed by a licensed therapist
- Current participation in a treatment program consisting of antidepressant medication and psychotherapy

- A minimum score of 15 on the Inventory of Depressive Symptomatology – Self Report
- Successful completion of the Physical Activity Readiness Questionnaire (PAR-Q) and medical history or medical clearance from the primary care physician
- Ambulatory

3.4.2 EXCLUSION CRITERIA

- Serious musculoskeletal pathologies (i.e. osteoarthritis, rheumatoid arthritis, oseteoporosis)
- Reporting any of the following signs or symptoms suggestive of cardiovascular disease:
    - Pain or discomfort in chest, neck, jaw, arms
    - Shortness of breath at rest or with mild exertion
    - Dizziness or syncope
    - Orthopnea or paroxysmal nocturnal dyspnea
    - Ankle edema
    - Palpitations or tachycardia
    - Intermittent claudication
    - Known heart murmur
    - Unusual fatigue or shortness of breath with usual activities
- Known cardiovascular (i.e. cardiovascular, peripheral vascular disease, or cerebrovascular disease), pulmonary (i.e. chronic obstructive pulmonary disease, asthma, interstitial lung disease, cystic fibrosis), or metabolic disorder (i.e. diabetes I and II, thyroid disorders, or renal or liver disease)

- Body Mass Index $\geq$35 kg/m^2
- Participation in a structured exercise program within the past 6 months (defined as exercising >20 minutes per day on at least three days per week)
- Female subjects who were pregnant or lactating

3.5 RESEARCH PROCEDURES

3.5.1 RECRUITMENT PROCEDURES

The majority of subject recruitment was obtained through therapist referrals. Prior to subject recruitment, the principal investigator met with the therapists of Western Psychiatric Institute and Clinic's Bellefield Clinic of the Adult Service Line to provide information regarding the study. Therapists discussed participation in the study with their patients and provided them with a handout describing the details of the study and contact information. These patients then contacted the primary investigator and were provided with a brief overview of the study to assess initial interest. Interested patients were then scheduled for eligibility screening.

Flyers including information about the study and the principal investigator's contact information were also posted in the waiting room of the Bellefield Clinic, as well as in area hospitals, churches, depression support group facilities, and the University Times (APPENDIX D). Individuals interested in more information contacted the principal investigator and were, again, provided with a brief overview of the study to assess initial interest. Interested patients were then scheduled for eligibility screening.

3.5.2 SCREENING PROCEDURES

In order to determine eligibility, subjects participated in screening procedures prior to the start of the intervention. Screening procedures were conducted at the Western Psychiatric Institute and Clinic's Bellefield Clinic of the Adult Service Line by the principal investigator.

Screening procedures took approximately 60 minutes to complete and included the Physical Activity Readiness Questionnaire (PAR-Q), medical history, and the IDS-SR.

The PAR-Q assessed the subject's readiness for physical activity and identified for whom physical activity may have been inappropriate (APPENDIX E). The PAR-Q included seven questions inquiring about a subject's current health status as it related to physical activity/exercise (i.e. Do you feel pain in your chest when you do physical activity?). If the subject answered "yes" to any of the seven questions, medical clearance from the primary care physician was required prior to participation. Subjects that required medical clearance to participate were provided a letter from the principal investigator describing the details of the study and the reason for medical clearance. The primary care physician was required to sign the letter approving participation and was asked to mail the signed letter to the principal investigator. (APPENDIX F)

The medical history examined the subject's current and past record of illnesses, surgeries and hospitalizations, orthopedic limitations, medication usage, and exercise history (APPENDIX G). The medical history also included diagnosis of clinical depression, duration of illness, and nature and intensity of concurrent treatment (i.e. antidepressant medication and dosage and psychotherapy). Diagnosis, duration of illness, and nature and intensity of concurrent treatment were also verified by the subject's primary therapist (subjects were asked to provide contact information of their primary therapist as well). The principal investigator sent a letter to the therapist requesting verification of this information. This verification letter was then sent back to the primary investigator (APPENDIX H).

Subjects who reported any signs or symptoms of disease including, pain or discomfort in chest, neck, jaw, arms, shortness of breath at rest or with mild exertion, dizziness or syncope,

orthopnea or paroxysmal nocturnal dyspnea, ankle edema, palpitations or tachycardia, intermittent claudication, known heart murmur, unusual fatigue or shortness of breath with usual activities, and/or any cardiac (cardiovascular, peripheral vascular disease, or cerebrovascular disease), pulmonary **(**chronic obstructive pulmonary disease, asthma, interstitial lung disease, cystic fibrosis), or metabolic disease (diabetes I and II, thyroid disorders, renal or liver disease) were classified as high risk and were excluded from participation. Additionally, subjects with a body mass index (BMI) of greater or equal to 35 kg/m^2 were excluded.

Subjects who reported hypertension, hypercholesterolemia, or impaired fasting glucose were required to obtain medical clearance from their primary care physician prior to participation. Subjects that were required to receive medical clearance were provided a letter from the principal investigator describing the details of the study and the reason for medical clearance. The primary care physician was required to sign the letter approving participation and returned the letter to the principal investigator (APPENDIX G).

The medical history also contained general demographic questions, such as age, gender, marital status, ethnicity, annual income, and education.

The IDS-SR was also conducted to screen for level of depressive symptoms. Potential subjects were required to score a minimum of 15 on the IDS-SR, ensuring that the individual was symptomatic and, therefore, could possibly benefit from the intervention.

3.5.3 ASSESSMENT PROCEDURES

Once eligibility was established, subjects underwent experimental assessment procedures. These procedures included psychological and physical assessments and were conducted on the same day. These assessments were administered at the University of Pittsburgh's Center for

Exercise and Health-Fitness Research Laboratory and took approximately 90 minutes to complete.

3.5.4 PSYCHOLOGICAL ASSESSMENTS

The psychological assessments included the IDS-SR, Q-LES-Q (short-form), and the Revised UCLA Loneliness Scale. These questionnaires were administered prior to the start of the intervention and immediately after the 6-week intervention. The primary investigator was blinded to the results of the psychological assessments in order to control for any possible testing bias. The primary investigator did not have access to any psychological data until the completion of the intervention.

The IDS-SR provided a sensitive measurement of changes in depressive symptoms, such as vegetative symptoms, cognitive changes, suicidal ideation and hopelessness, mood disturbances and quality of mood, endogenous symptoms, and symptoms of anxiety, as a result of treatment. The IDS-SR was a self-report measure consisting of 30-items. Items were rated on a 0 to 3 scale with a higher score indicating greater severity of depressive symptoms. The IDS-SR assessed symptoms from the previous 7 days, except for weight gain which was rated for the previous 14 days. Although the IDS-SR had not been used in previous research assessing the changes in depressive symptoms as a result of an exercise intervention, it was chosen for this study because it ensured a more adequate assessment of symptoms used to define clinical depression, as compared to the Hamilton Rating Scale for Depression and the Beck Depression Inventory (most commonly used assessments). The IDS-SR has been highly correlated with the Hamilton Depression Scale ($r = 0.92$) and has shown strong internal consistency (Cronbach's alpha = 0.94) and concurrent validity ($r = 0.49$) (Rush, 1996).

The Q-LES-Q (short-form) was a self-report measurement assessing the degree of enjoyment and satisfaction experienced by subjects in general activities, such as work, household activities, social relationships, family relationships, and leisure time activities. Since individuals suffering from depression are known to typically experience a significant decrease in feelings of pleasure and satisfaction with activities resulting in a decreased quality of life, assessing quality of life was of value. The Q-LES-Q (short-form) consisted of 14 items. Questions were scored on a 5-point scale, with higher scores indicating greater feelings of enjoyment and satisfaction with general activities. Scores were based on the previous week and were expressed as a percentage of the total score (70 is total available score). Percentages were then used to make comparisons within the same subject or groups of subjects. In addition, the Q-LES-Q (short-form) consisted of two separately scored questions that assessed the satisfaction of medication and overall life satisfaction and contentment. The format and content of the Q-LES-Q (short-form) was applicable for the assessment of subjects with a variety of mental disorders and has been used frequently in research studies using depressed populations (Endicott, 1993).

The Revised UCLA Loneliness Scale was a self-report measurement of loneliness reflecting satisfaction or dissatisfaction with social relationships. Since feelings of loneliness co-occur with depression and contribute to depressive symptoms, the measurement of loneliness was of interest. This assessment was used to assist in differentiating changes in depressive scores as a result of the exercise intervention or social interaction. The Revised UCLA Loneliness Scale consisted of 20-items on a 4-point scale, ranging from never (1) to often (4). Ten questions each reflected satisfaction and dissatisfaction with social relationships. Scores ranged from 20 to 80, with higher scores indicating stronger feelings of loneliness. This scale

has strong concurrent validity (r = 0.62) and internal consistency (coefficient alpha of .94) (Russell, 1980).

3.5.5 PHYSICAL ASSESSMENTS

Physical assessments were also conducted prior to the start of the intervention. Assessments were administered by the principal investigator and included a physical activity questionnaire, the recording of body height and weight, resting heart rate and blood pressure, cardiorespiratory fitness, and muscular strength. The purpose of the physical assessments was to collect baseline information to indicate health and fitness status. The physical assessments were not conducted at the end of the intervention, as it was believed that 6-weeks were not sufficient to see any significant change.

The Modifiable Activity Questionnaire was used to assess initial physical activity habits, as well as to assess if any changes in activity level occurred over the course of the intervention. Specifically, it was important to verify that physical activity levels did not increase for those randomized to the social control group during study participation. An increase in physical activity levels for this group would have introduced biases in results making it difficult for result interpretation. This questionnaire consisted of 6 questions assessing past-year and past-week occupational (i.e. industrial work, carpentry, construction) and leisure activities (i.e. jogging, walking, swimming, team sports, and gardening), as well as inactivity due to disability.

Body height and weight were measured using a calibrated non-metric platform-beam scale with a stadiometer. Resting heart rate was assessed using a standard Polar heart rate monitor after a 5 to 10 minute rest period. A seated resting blood pressure was measured on the left brachial artery using a standard aneroid sphygmomanometer and stethoscope after a 5 to 10 minute rest period.

Cardiorespiratory fitness has been defined as the ability of the heart, lungs, and circulatory system to supply oxygen and nutrients to the working muscles. Maximal oxygen uptake (VO_{2max}), defined as the maximal amount of oxygen used by the body during an intense bout of dynamic exercise, has been the accepted criterion measure of cardiorespiratory fitness. VO_{2max} was predicted using the YMCA Submaximal Cycle Ergometer Test. This test consisted of two to four, 3-minute stages of continuous exercise, with each stage increasing in intensity (work load (resistance) increases). Pedal rate was maintained at 50 revolutions per minute for the duration of the test. A metronome was used to assist the subject in regulating pedal frequency. Heart rate, assessed using a standard Polar heart rate monitor, and blood pressure, assessed using a calibrated aneroid sphygmomanometer and stethoscope, were monitored at the end of each 3-minute stage. The test was designed to raise the subject's heart rate between 110 beats per minute and 85% of the age-predicted maximal heart rate for at least two consecutive stages. The test was terminated once the subject reached 85% of their age-predicted maximal heart rate or if the subject requested to stop. At the completion of the test, subjects were given a 4-minute active cool-down, or longer, if desired. During the cool-down, subjects continued to pedal on the bike at a lower intensity and pedal frequency. Heart rate and blood pressure were also monitored during each minute of the cool-down. The heart rate response during the cycle ergometer test was then used with a specific equation to predict VO_{2max}, and thus cardiorespiratory fitness.

Muscular strength has been defined as the ability of skeletal muscle to maximally contract against resistance one time. Muscular strength was measured using the grip strength test. Subjects were asked to squeeze a hand dynamometer (an instrument that assesses grip strength – action is similar to squeezing a "hand stress ball") as hard as possible. Subjects were asked to perform three trials alternately with each hand, with at least 30 seconds between trials.

The highest score from each hand was then summed and a percentile score based on normative data was determined.

3.5.6 GROUP ASSIGNMENTS

Following psychological and physical assessments, subjects were randomly assigned to either the group exercise intervention or the social control group (stress coping intervention).

3.5.7 GROUP EXERCISE INTERVENTION

Subjects assigned to the exercise group attended two, 1-hour group sessions per week for a total of 6-weeks. Exercise sessions were held on Monday and Wednesday evenings from 6:00 to 7:00 pm at the Three Rivers Sports Medicine and Fitness Center. The principal investigator, assisted by one experienced exercise physiologist, led all exercise sessions.

Each exercise session began with a 10 minute warm-up consisting of light aerobic activity and static stretching. Specific "aerobic" music was used to keep subjects moving at a uniform beat per minute (bpm = 125-138). The aerobic segment of the warm-up included low-impact, low-intensity traditional floor aerobic moves, such as marching in place, toe-touches, and side steps. Static stretching exercises were performed targeting all major joints of the body (hip, back, shoulder, knee, upper trunk, and neck). Stretches were performed slowly and held for 30 seconds. Subjects were instructed on proper stretching form.

Following the warm-up, subjects participated in a 35-minute interval training program that alternated between two minutes of resistance exercises and three minutes of aerobic activity. During the resistance interval, the exercises performed targeted all major muscle groups. Each resistance interval consisted of two exercises performed for one minute each. Subjects had the option to use hand weights, tubing, and/or resistance bands. The primary investigator assisted each subject in selecting the appropriate resistance. Aerobic intervals consisted of various

traditional low-impact exercises. Subjects were instructed on the correct techniques and were encouraged to work within their "comfort zone" during the course of each class. A 15 minute cool-down that consisted of light aerobic activity and static stretching exercises followed each training session (APPENDIX I).

3.5.8 SOCIAL CONTROL GROUP (Stress Coping Intervention)

The inclusion of a social control group was imperative for the methodological quality of the study. Social interaction has been proposed as a possible mechanism by which exercise may reduce depressive symptoms. Therefore, the use of a social control group assisted in differentiating the effect of social interaction from the true effectiveness of the exercise intervention.

Subjects assigned to the social control group performed stress coping activities. Group exposure (i.e. contact hours) matched that of the exercise intervention. Subjects attended two, 1-hour group sessions for 6-weeks. Stress coping sessions were held on Tuesday and Thursday evenings from 6:00 to 7:00 pm at the UPMC Comprehensive Heart Center. An experienced stress coping instructor led all sessions and was assisted by the principal investigator.

The group was instructed in behaviors that minimize the psychological and physiological imbalances associated with stress. Each session consisted of a 25 minute stress coping education session (i.e. effects of stress on physical and mental health), 15 minute demonstration on techniques for reducing stress responses (i.e. diaphragmatic breathing, progressive relaxation, focusing, and guided imagery), and 20 minute technique practice session. The format and topic for each session was provided by the UPMC Health Enhancement Program (APPENDIX J).

It was not revealed to subjects that the stress coping intervention was a social control group. Subjects were told that both groups were being investigated as possible adjunct treatment

modalities for depression. This was done in order to prevent discouraging subjects from participating in the study if they were randomized to the social control group, as well as to prevent any testing bias. Subjects, however, were given the opportunity to participate in the exercise intervention at the conclusion of the study.

3.5.9 INSTRUCTOR EVALUATIONS

Instructors for the exercise and stress coping interventions were evaluated by subjects at the completion of the study. This was done to verify that the intervention instruction was comparable, thereby reducing the likelihood that results were influenced by the relationship between the instructor and subjects. Subjects were asked not to identify themselves in order to maintain anonymity (APPENDIX K).

3.6 STATISTICAL ANALYSIS

3.6.1 POWER ANALYSIS

Based on an expected group effect size difference of $n^2 = 1.0$ (exercise group; mean = 12, standard deviation = 5; social control group; mean = 17, standard deviation = 5) and an alpha level of 0.05 (one-sided hypothesis test), 14 subjects per group were required for a statistical power of P = .80. The expected group effect size difference was based on typical initial IDS-SR scores (mean = 20, standard deviation = 6) in depressed patients. In order to account for a 20% attrition rate due to subject withdrawal four additional subjects were recruited; therefore a total of 31 subjects were enrolled to participate in this study.

3.6.2 STATISTICAL ANALYSES

Analyses were performed using the Statistical Package for the Social Sciences (SPSS, 11.0). Independent t-tests were used to determine initial group scores on demographic data and the IDS-SR to ensure that homogeneity existed between both groups. Separate two-way,

repeated measures ANOVA (group x time) were used to examine mean score differences between and within groups on the IDS-SR, Q-LES-Q (short-form), and the Revised UCLA Loneliness Scale at 0 and 6-weeks. Statistical significance was defined a priori at an alpha level of 0.05.

Despite the fact that the current study used a randomized clinical trial design, the two-way repeated measures ANOVA was also extended to include gender, age, ethnicity, marital status, education level, socioeconomic status, duration of illness, and severity of illness in order to assess these variables as potential confounding factors.

Additionally, the present investigation used an intent-to-treat analysis to determine the true effectiveness of the exercise intervention. Subjects who chose to withdrawal from participation were asked to complete post-intervention (6-week) psychological assessments to be included in the final group analysis. If the post-intervention psychological assessment data was not available (i.e. loss of communication with subject), scores from the last testing session were extrapolated to the post-intervention time point and were used in the final analysis. Subjects were analyzed in the group to which they were randomized.

4 RESULTS

The purpose of this study was to evaluate the influence of a 6-week group exercise intervention on depressive symptoms, quality of life, and feelings of loneliness in subjects who had a current diagnosis of depression (dysthymic disorder, major depressive disorder, depressive disorder not otherwise specified, or bipolar disorder) according to the DSM-IV and who were currently enrolled in a traditional treatment program consisting of antidepressant medication and psychotherapy. Thirty-one ambulatory males and females, between the ages of 25 and 60 years, were recruited from Western Psychiatric Institute and Clinic's Bellefield Clinic of the Adult Service Line, as well as from area hospitals, churches, and depression treatment programs. Subjects were randomly assigned to either a group exercise intervention or a social control group (stress coping intervention). Subjects assigned to the exercise group underwent two, 1 hour sessions per week. Each session consisted of a 10 minute warm-up, a 35 minute resistance/aerobic interval training program, and a 15 minute cool down. Subjects assigned to the social control group participated in a stress-coping intervention and were instructed in behaviors that minimized the psychological and physiological imbalances associated with stress. Group exposure (i.e. contact hours) matched that of the group exercise intervention. The Inventory of Depressive Symptomatology – Self Report (IDS-SR), the Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form (Q-LES-Q), and the Revised UCLA Loneliness Scale were used to assess changes in depressive symptoms, quality of life, and feelings of loneliness, respectively, as a result of the intervention at 0 and 6-weeks. Independent t-tests were used to examine initial scores for the IDS-SR and demographic data to verify group homogeneity. Separate two-way, repeated measures ANOVA (group x time) were used to determine between and within group mean differences on the IDS-SR, Q-LES-Q (short-form),

and the Revised UCLA Loneliness Scale at 0 and 6-weeks. Additionally, separate two-way, repeated measures ANOVA were extended to include gender, age, ethnicity, marital status, education level, occupation, annual income, duration of illness, and severity of illness as potential confounders. It was hypothesized that subjects assigned to the group exercise intervention would demonstrate a significant decrease in depressive symptoms, as assessed by the IDS-SR, and a significant increase in quality of life, as assessed by the Q-LES-Q (short-form), when compared to the social control group (stress coping group). It was also hypothesized that subjects assigned to the group exercise intervention and the social control group would demonstrate a significant and equal decrease in feelings of loneliness, as assessed by the Revised UCLA Loneliness Scale.

4.1 EXPRESSING RESULTS

Results from this investigation have been presented in 2 ways: 1) data expressed as the intent-to-treat analysis and 2) data expressed without the intent-to-treat analysis (i.e. excluding those who discontinued participation). This was done to determine if the results differed from those who enrolled in the study initially but discontinued participation (intent-to-treat-group) from those who enrolled and completed the study (non-intent-to-treat-group). For the intent-to-treat analysis, subjects who withdrew from participation were asked to complete post-test (6-week) psychological assessments to be used in the final analysis. If post-test data were not available for a subject who withdrew participation, the subject's pre-test scores were extrapolated to the post-test time point to be used in the final analysis. For the non-intent-to-treat analysis, results accounted for subjects who completed the study only. It does not include subjects who withdrew from participation.

4.2 DATA EXPRESSED WITH THE INTENT-TO-TREAT ANALYSIS

4.2.1 COMPLIANCE

A total of 31 subjects enrolled for participation in the present investigation. A total of 10 subjects withdrew from the study resulting in an adherence rate of 68%. Subjects were required to attend a total of 12 sessions (2 times/week) over a 6-week period. Subjects assigned to the exercise group attended 6 ± 4 (20 – 80%) sessions and subjects assigned to the social control group attended 5 ± 4 (9 – 77%) sessions. Discontinuation from participation included the following reasons:

- 30% - Time commitment issues (3)
- 30% - Did not enjoy the group to which they were assigned to (3)
- 20% - Developed a worsening of symptoms (2)
- 10% - Personal issues (1)
- 10% - Decided they no longer wanted to participate (1)

4.2.2 SUBJECT DEMOGRAPHIC AND PHYSICAL CHARACTERISTICS

Out of the total 31 enrolled subjects, 10 were males and 21 were females. Six males and 11 females were randomized to the group exercise intervention and 4 males and 10 females were randomized to the social control group. Subjects were between the ages of 25 and 60 years with a verified diagnosis of clinical depression according to the DSM-IV and were enrolled in an outpatient treatment program consisting of antidepressant medication and psychotherapy. Independent t-tests were conducted to determine group homogeneity for demographic and physical characteristics. No significant differences were found. Pertinent subject demographics and characteristics are presented in Table 1 - 8.

Table 1: Depression Diagnosis (Total Number and Percentages)

Depression Type	Exercise Group	Social Control Group	Total
Major Depressive Disorder	15 (88.2%)	13 (92.9%)	28 (90.3%)
Bipolar Disorder	1 (5.9%)	1 (7.1%)	2 (6.5%)
Depressive Disorder Not Otherwise Specified	1 (5.9%)	0.0 (0%)	1 (3.2%)

Table 2: Subject Physical and Depression Characteristics Data (Means and Standard Deviations)

Variable	Exercise Group	Social Control Group	Total
Age (years)	46.5 (8.2)	45.6 (12.4)	46.1 (10.1)
Height (m)	1.67 (0.07)	1.67 (0.09)	1.67 (0.08)
Mass (kg)	80.88 (13.91)	88.18 (24.14)	84.18 (19.22)
BMI (kg/m^2)	29.06 (4.39)	31.59 (8.21)	30.2 (6.42)
Duration of Illness (years)	4.6 (5.3)	10.7 (8.1)	7.3 (7.3)
Severity of Illness (IDS-SR Scores)	29.88 (14.74)	33.71 (10.45)	31.61 (12.92)

Table 3: Marital Status (Total Numbers and Percentages)

Marital Status	Exercise Group	Social Control Group	Total
Married	3 (17.6%)	5 (35.7%)	8 (25.8%)
Single	7 (41.2%)	9 (64.3%)	16 (51.6%)
Widowed	1 (5.9%)	0 (0.0%)	1 (3.2%)
Divorced	6 (35.3%)	0 (0.0%)	6 (19.4%)

Table 4: Ethnicity (Total Numbers and Percentages)

Ethnicity	Exercise Group	Social Control Group	Total
Caucasian	12 (70.6%)	11 (78.6%)	23 (74.2%)
African-American	3 (17.6%)	2 (14.3%)	5 (16.1%)
Native American	1 (5.9%)	1 (7.1%)	2 (6.5%)
Asian	1 (5.9%)	0 (0.0%)	1 (3.2%)

Table 5: Education Level (Total Numbers and Percentages)

Education Level	Exercise Group	Social Control Group	Total
High School/GED	3 (17.6%)	3 (21.4%)	6 (19.4%)
Vocational Training	2 (11.8%)	0 (0.0%)	2 (6.5%)
Some College/Associates Degree	8 (47.1%)	1 (7.1%)	9 (29.0%)
College Graduate	2 (11.8%)	6 (42.9%)	8 (25.8%)
Masters Degree	1 (11.8%)	3 (21.4%)	4 (12.9%)
Doctoral Degree	1 (5.9%)	1 (7.1%)	2 (6.5%)

Table 6: Occupation (Total Numbers and Percentages)

Occupation	Exercise Group	Social Control Group	Total
Working Full Time	6 (35.3%)	4 (28.6%)	10 (32.3%)
Working Part Time	2 (11.8%)	2 (14.3%)	4 (12.9%)
Not Currently Working – Looking for Work	2 (11.8%)	3 (21.4%)	5 (16.1%)
Retired	1 (5.9%)	1 (7.1%)	2 (6.5%)
Homemaker	1 (5.9%)	0 (0.0%)	1 (3.2%)
Disability	3 (17.6%)	4 (28.6%)	7 (22.6%)
Other	2 (11.8%)	0 (0.0%)	2 (6.5%)

Table 7: Annual Income (Total Numbers and Percentages)

Annual Income	Exercise Group	Social Control Group	Total
Refused to Disclose Information	2 (11.8%)	1 (7.1%)	3 (9.7%)
Less than $5,000	2 (11.8%)	1 (7.1%)	3 (9.7%)
$5,000-9,999	3 (17.6%)	4 (28.6%)	7 (22.6%)
$10,000-14,999	1 (5.9%)	1 (7.1%)	2 (6.5%)
$15,000-19,999	0 (0.0%)	2 (14.3%)	2 (6.5%)
$20,000-29,999	4 (23.5%)	3 (21.4%)	7 (22.6%)
$30,000-39,999	0 (0.0%)	1 (7.1%)	1 (3.2%)
$40,000-49,000	1 (5.9%)	0 (0.0%)	1 (3.2%)
$50,000-59,999	3 (17.7%)	0 (0.0%)	3 (9.7%)
$60,000-74,000	0 (0.0%)	1 (7.1%)	1 (3.2%)
Greater than $100,000	1 (5.9%)	0 (0.0%)	1 (3.2%)

Table 8: Fitness Level (Means and Standard Deviations)

Fitness Level	Exercise Group	Social Control Group	Total
Cardiorespiratory Fitness- VO_{2max}	37.05 (12.28) $ml \cdot kg^{-1} \cdot min^{-1}$	41.45 (19.09) $ml \cdot kg^{-1} \cdot min^{-1}$	39.0 (15.5) $ml \cdot kg^{-1} \cdot min^{-1}$
Muscular Strength	68.9 (19.3) kg	65.0 (17.5) kg	67.2 (18.3) kg

4.2.3 INVENTORY OF DEPRESSIVE SYMPTOMATOLOGY –SELF-REPORT

In order to verify group homogeneity, an independent t-test was used to compare initial differences for the IDS-SR between the group exercise intervention and the social control group (stress coping intervention). No significant differences existed between the two groups for the IDS-SR at 0-weeks ($t = -0.358$, $p = 0.723$). Initial pre-test data for the IDS-SR are presented in Table 9.

Table 9: IDS-SR Pre-Test (Mean Scores and Standard Deviations)

Group	Pre-Test
Exercise Intervention	28.82 **(**15.15)
Social Control Group	30.57 (10.89)

A two-way, repeated measures ANOVA was used to determine mean differences in the IDS-SR scores between the group exercise intervention and the social control group across the 6-

week intervention. A significant difference existed in the time main effect (F = 4.281, p = 0.048) indicating that both groups experienced a decrease in depressive scores on the IDS-SR. No significant time by group interaction (F = 0.947, p = 0.339) was found. IDS-SR mean scores and standard deviations data are presented in Table 10. Graphical representation of the IDS-SR mean scores are presented in Figure 1.

Table 10: IDS-SR Pre-test/Post-test Scores (Mean Scores and Standard Deviations)

Group	Pre-Test	Post-Test
Exercise Intervention	28.82 **(**15.15)	27.18 (16.18)
Social Control Group	30.57 (11.26)	26.00 (10.28)
Total	29.61 (13.48)	26.65 (13.63)

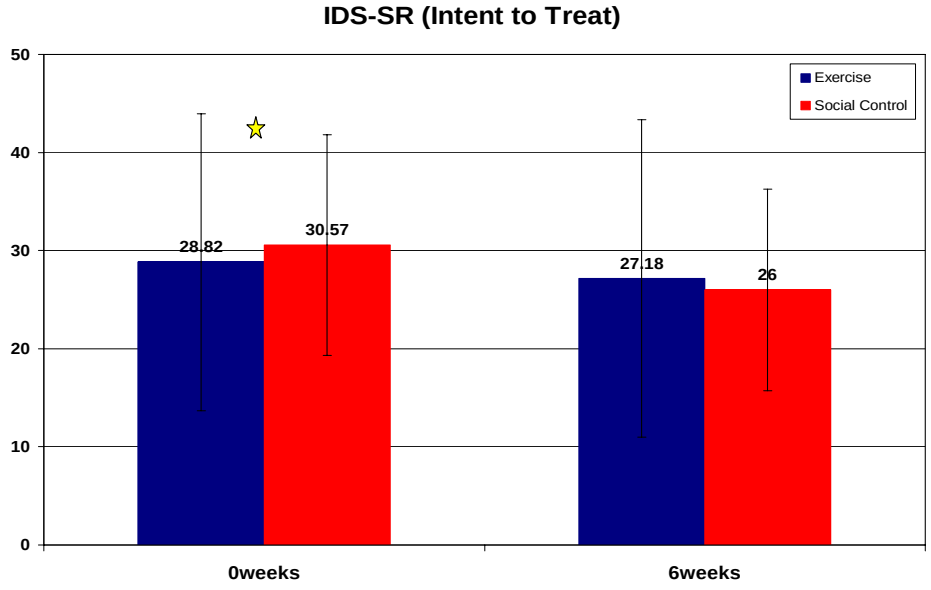

Figure 1: IDS-SR Mean Scores for Intent-to-Treat-Two-Way-ANOVA Analysis (*Significant pretest/posttest main effect)

4.2.4 QUALITY OF LIFE AND ENJOYMENT SATISFACTION QUESTIONNAIRE – SHORT-FORM

An independent t-test was also used to compare initial group differences for the Q-LES-Q (short-form) between the group exercise intervention and the social control group (stress coping intervention) to determine that both groups were homogeneous. No significant differences existed between the two groups for the Q-LES-Q (short-form) at 0-weeks ($t = 0.189$, $p = 0.851$). Initial pre-test data for the Q-LES-Q presented in Table 11.

Table 11: Q-LES-Q Pre-test (Mean Scores and Standard Deviations)

Group	Pre-Test
Exercise Intervention	43.12 (11.2)
Social Control Group	42.4 (8.5)

A two-way, repeated measures ANOVA was used to determine mean differences in the Q-LES-Q scores between the group exercise intervention and the social control group across the 6-week intervention. No significant differences existed in time main effect ($F = 3.354$, $p = 0.077$) or time by group interaction ($F = 0.09$, $p = 0.766$). Q-LES-Q mean score and standard deviation data are presented in Table 12. Graphical representation of the Q-LES-Q mean scores are presented in Figure 2.

Table 12: Q-LES-Q Pre-test/Post-test Scores (Mean Scores and Standard Deviations)

Group	Pre-Test	Post-Test
Exercise Intervention	43.12 (11.2)	45.12 (11.06)

Social Control Group	42.43 (8.5)	45.21 (9.32)
Total	42.81 (9.92)	45.16 (10.14)

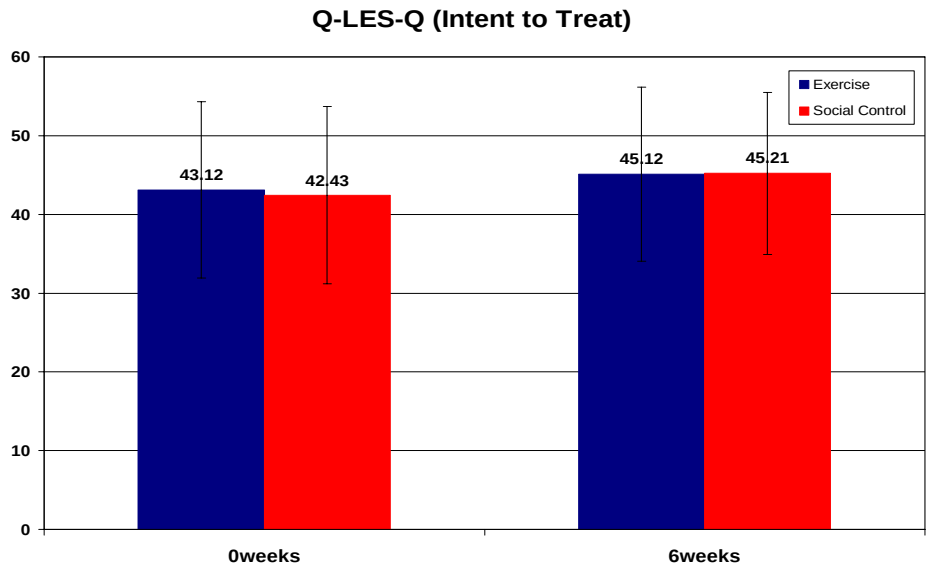

Figure 2: Q-LES-Q Mean Scores for the Intent-to-Treat-Two-Way-ANOVA Analysis

4.2.5 REVISED UCLA LONELINESS SCALE

Group homogeneity was again verified using an independent t-test to compare initial group differences for the Revised UCLA Loneliness Scale between the group exercise intervention and the social control group (stress coping intervention). No significant differences existed between the two groups for the Revised UCLA Loneliness Scale at 0-weeks ($t = 0.105$, $p = 0.917$). Initial pre-test data for the Revised UCLA Loneliness Scale presented in Table 13.

Table 13: Revised UCLA Loneliness Scale- Pre-test (Mean Scores and Standard Deviations)

Group	Pre-Test
Exercise Intervention	45.29 (12.03)
Social Control Group	44.86 (10.89)

A two-way, repeated measures ANOVA was used to determine mean differences in the Revised UCLA Loneliness Scale scores between the group exercise intervention and the social control group across the 6-week intervention. No significant differences existed in time main effect ($F = 2.125$, $p = 0.156$) or time by group interaction ($F = 1.763$, $p = 0.195$). The Revised UCLA Loneliness Scale mean score and standard deviation data are presented in Table 14. Graphical representation of the Revised UCLA Loneliness Scale mean scores are presented in Figure 3.

Table 14: Revised UCLA Loneliness Scale- Pre-test/Post-test Scores (Mean Scores and Standard Deviations)

Group	Pre-Test	Post-Test
Exercise Intervention	45.29 (12.03)	45.12 (13.32)
Social Control Group	44.86 (10.89)	41.07 (10.77)
Total	45.10 (11.34)	43.29 (12.21)

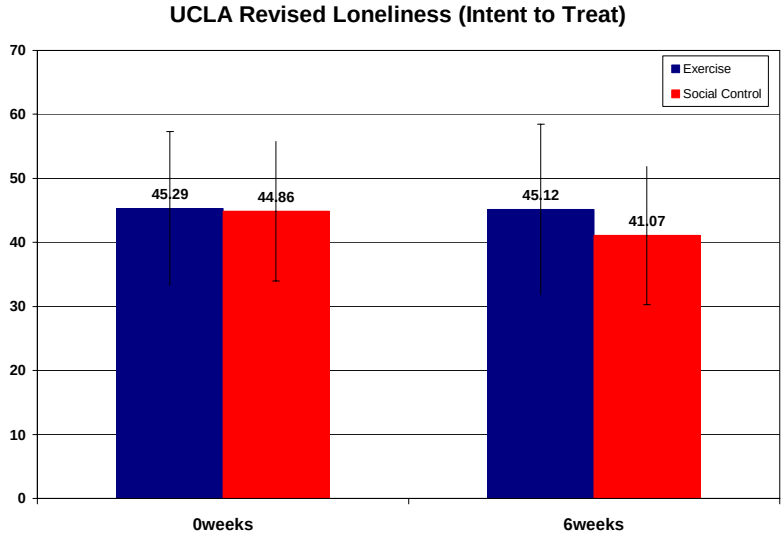

Figure 3: Revised UCLA Loneliness Scale Mean Scores for the Intent-to-Treat-Two-Way-ANOVA Analysis

4.2.6 POSSIBLE CONFOUNDERS

The two-way repeated measures ANOVA was also extended to determine any possible confounders that may have contributed to test or group differences on the IDS-SR, Q-LES-Q (short form), and the UCLA Revised Loneliness Scale. Possible confounders included gender, age, ethnicity, marital status, education level, occupation, annual income, duration of illness, and severity of illness. Results are described below. Mean scores and standard deviations are presented only for confounders that resulted in a significant finding and can be found in

4.2.6.1 GENDER

Results indicated that a time by gender interaction ($F = 4.553$, $p = 0.042$) for the Q-LES-Q was found. Results also indicated that no time main effect, time by gender interaction, or time by group interaction occurred with any of the other dependent variables ($p > 0.05$).

4.2.6.2 AGE

As a potential confounder, age did not result in a time main effect, time by age interaction, or time by group interaction ($p > 0.05$).

4.2.6.3 ETHNICITY

A time main effect for the Revised UCLA Loneliness Scale was found for ethnicity ($F = 5.235$, $p = 0.030$). No time main effect, time by ethnicity, or time by group interaction occurred with the other dependent variables ($p > 0.05$).

4.2.6.4 MARITAL STATUS

As a potential confounder, marital status did not result in a time main effect, time by marital interaction, or time by group interaction ($p > 0.05$).

4.2.6.5 EDUCATION LEVEL

A time by education interaction was found for the Q-LES-Q ($F = 4.55$; $p = 0.042$) and the Revised UCLA Loneliness Scale ($F = 4.873$, $p = 0.036$). No time main effect or time by group interaction existed for the other dependent variables ($p > 0.05$).

4.2.6.6 OCCUPATION

Results indicated a time main effect ($F = 12.260$, $p = 0.002$) and a time by occupation interaction ($F = 9.601$, $p = 0.004$ for the Revised UCLA Loneliness Scale. No other time main effect, time by occupation interaction, or time by group interaction occurred or the other dependent variables ($p > 0.05$).

4.2.6.7 ANNUAL INCOME

As a potential confounder, annual income did not result in a time main effect, time by annual income interaction, or time by group interaction ($p > 0.05$).

4.2.6.8 DURATION OF ILLNESS

Duration of illness did not result in a time main effect, time by duration of illness interaction, or duration of illness by group interaction ($p > 0.05$).

4.2.6.9 SEVERITY OF ILLNESS

No time main effect, time by severity of illness interaction, or severity of illness by group interaction occurred for any of the dependent variables ($p > 0.05$).

4.3 DATA EXPRESSED WITH THE NON-INTENT-TO-TREAT ANALYSIS

4.3.1 COMPLIANCE

A total of 21 subjects completed the study. Subjects were required to attend a total of 12 sessions (2 times/week) over a 6-week period. On average, subjects assigned to the exercise group attended 7 ± 3 (30 – 80%) sessions and subjects assigned to the social control group attended 8 ± 2 (52 – 85%) sessions.

4.3.2 SUBJECT DEMOGRAPHIC AND PHYSICAL CHARACTERISTICS

Out of the total 21 subjects, 6 were males and 15 were females. Four males and 9 females were randomized to the group exercise intervention and 2 males and 6 females were randomized to the social control group. Subjects were between the ages of 25 and 60 years with a diagnosis of clinical depression according to the DSM-IV and were enrolled in an outpatient treatment program consisting of antidepressant medication and psychotherapy. Independent t-tests were conducted to determine group homogeneity for demographic and physical characteristics. No significant differences were found. Pertinent subject demographics and characteristic are presented in Table 15-22.

Table 15: Depression Diagnosis (Total Numbers and Percentages)

Depression Type	Exercise Group	Social Control Group	Total
Major Depressive Disorder	12 (92.3%)	7 (87.5%)	19 (90.5%)
Bipolar Disorder	0 (0.0%)	1 (12.5%)	1 (4.8%)
Depressive Disorder	1 (7.7%)	0 (0.0%)	1 (4.8%)

Not Otherwise Specified

Table 16: Subject Physical and Depression Characteristics Data (Means and Standard Deviations)

Variable	Exercise Group	Social Control Group	Total
Age (years)	46.0 (8.4)	42.9 (11.4)	44.8 (9.5)
Height (m)	1.67 (0.07)	1.66 (0.10)	1.66 (0.08)
Mass (kg)	81.03 (14.22)	83.38 (24.85)	81.93 (18.41)
BMI (kg/m^2)	29.15 (4.82)	29.84 (6.78)	29.4 (5.49)
Duration of Illness (years)	3.9 (5.5)	9.9 (7.3)	6.2 (6.8)
Severity of Illness (IDS-SR Scores)	28.77 (15.51)	38.25 (10.71)	32.38 (14.38)

Table 17: Marital Status (Total Numbers and Percentages)

Marital Status	Exercise Group	Social Control Group	Total
Married	3 (23.1%)	1 (12.5%)	4 (19.0%)
Single	5 (38.5%)	7 (87.5%)	12 (57.1%)
Widowed	1 (7.7%)	0 (0.0%)	1 (4.8%)
Divorced	4 (30.8%)	0 (0.0%)	4 (19.0%)

Table 18: Ethnicity (Total Numbers and Percentages)

Ethnicity	Exercise Group	Social Control Group	Total
Caucasian	10 (76.9%)	7 (87.5%)	17 (81.0%)
African-American	3 (23.1%)	1 (12.5%)	4 (19.0%)
Native American	0 (0.0%)	0 (0.0%)	0 (0.0%)
Asian	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 19: Education Level (Total Numbers and Standard Deviations)

Education Level	Exercise Group	Social Control Group	Total
High School/GED	2 (15.4%)	1 (12.5%)	3 (14.3%)
Vocational Training	2 (15.4%)	0 (0.0%)	2 (9.5%)
Some College/Associates Degree	6 (46.2%)	1 (12.5%)	7 (33.3%)
College Graduate	1 (7.7%)	3 (37.5%)	4 (19.0%)
Masters Degree	1 (7.7%)	3 (37.5%)	4 (19.0%)
Doctoral Degree	1 (7.7%)	0 (0.0%)	1 (4.8%)

Table 20: Occupation (Total Numbers and Standard Deviations)

Occupation	Exercise Group	Social Control Group	Total
Working Full Time	6 (46.2%)	2 (25.0%)	8 (38.1%)
Working Part Time	1 (7.7%)	2 (25.0%)	3 (14.3%)
Not Currently Working – Looking for	1 (7.7%)	2 (25.0%)	3 (14.3%)

Work			
Retired	1 (7.7%)	0 (0.0%)	1 (4.8%)
Homemaker	0 (0.0%)	0 (0.0%)	0 (0.0%)
Disability	2 (15.4%)	2 (25.0%)	4 (19.0%)
Other	2 (15.4%)	0 (0.0%)	2 (9.5%)

Table 21: Annual Income (Total Numbers and Percentages)

Annual Income	Exercise Group	Social Control Group	Total
Refused to Disclose Information	2 (15.4%)	1 (12.5%)	3 (14.3%)
Less than $5,000	1 (7.7%)	1 (12.5%)	2 (9.5%)
$5,000-9,999	1 (7.7%)	3 (37.5%)	4 (19.0%)
$10,000-14,999	0 (0.0%)	0 (0.0%)	0 (0.0%)
$15,000-19,999	0 (0.0%)	1 (12.5%)	1 (4.8%)
$20,000-29,999	4 (30.8%)	1 (12.5%)	5 (23.8%)
$30,000-39,999	0 (0.0%)	1 (12.5%)	1 (4.8%)
$40,000-49,000	1 (7.7%)	0 (0.0%)	1 (4.8%)
$50,000-59,999	3 (23.1%)	0 (0.0%)	3 (14.3%)
$60,000-74,000	0 (0.0%)	0 (0.0%)	0 (0.0%)
Greater than $100,000	1 (7.7%)	0 (0.0%)	1 (4.8%)

Table 22: Fitness Level (Means and Standard Deviations)

Fitness Level	Exercise Group	Social Control Group	Total
Cardiorespiratory Fitness- VO_{2max}	37.9 (13.3) $ml \cdot kg^{-1} \cdot min^{-1}$	36.2 (16.2) $ml \cdot kg^{-1} \cdot min^{-1}$	37.2 (14.1) $ml \cdot kg^{-1} \cdot min^{-1}$
Muscular Strength	65.1 (16.3) kg	59.1 (16.6) kg	62.8 (16.3) kg

4.3.3 INVENTORY OF DEPRESSIVE SYMPTOMATOLOGY – SELF-REPORT

An independent t-test was used to compare initial group differences for the IDS-SR between the group exercise intervention and the social control group (stress coping intervention). This was done to verify group homogeneity. No significant differences existed between the two groups for the IDS-SR at 0-weeks ($t = -1.339$, $p = 0.196$). Initial pre-test data for the IDS-SR are presented in Table 23.

Table 23: IDS-SR Pre-test (Means and Standard Deviations)

Group	Pre-Test
Exercise Intervention	26.46 (14.05)
Social Control Group	34.75 (13.29)

A two-way, repeated measures ANOVA was used to determine mean differences in the IDS-SR scores between the group exercise intervention and the social control group across the 6-week intervention. A significant main effect for time ($F = 5.457$, $p = 0.031$) was found for both groups indicating that the IDS-SR scores significantly improved in both groups following the intervention. No significant difference for time by group interaction ($F = 1.809$, $p = 0.194$) was found. IDS-SR mean score and standard deviation data presented in Table 24. Graphical representation of the IDS-SR mean scores are presented in Figure 4.

Table 24: IDS-SR Pre-test/Post-test Scores (Mean Scores and Standard Deviations)

GROUP	PRE-TEST	POST-TEST
Exercise Intervention	26.46 (14.05)	24.31 (15.11)
Social Control Group	34.75 (13.29)	26.75 (13.50)
Total	29.62 (14.04)	25.24 (14.22)

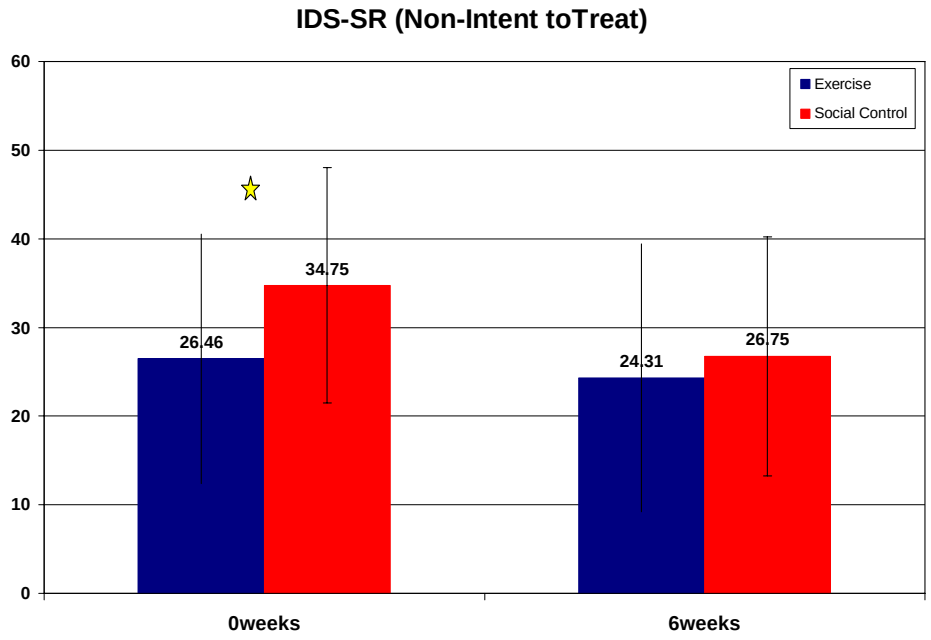

Figure 4: IDS-SR Mean Scores for the Non-Intent-to-Treat-Two-Way-ANOVA Analysis (*Significant pretest/posttest main effect)

4.3.4 QUALITY OF LIFE AND ENJOYMENT SATISFACTION QUESTIONNAIRE – SHORT-FORM

An independent t test was also used to compare initial group differences for the Q-LES-Q (short-form) between the group exercise intervention and the social control group (stress coping intervention) to verify that both groups were homogeneous. No significant differences existed between the two groups for the Q-LES-Q (short-form) at 0-weeks ($t = 1.577$, $p = 0.131$). Initial pre-test data for the Q-LES-Q presented in Table 25.

Table 25: Q-LES-Q Pre-test (Means and Standard Deviations)

Group	Pre-Test
Exercise Intervention	45.31 (10.36)
Social Control Group	38.75 (6.96)

A two-way, repeated measures ANOVA was used to determine mean differences in the Q-LES-Q scores between the group exercise intervention and the social control group across the 6-week intervention. No significant differences existed in time main effect ($F = 3.578$, $p = 0.074$) or time by group interaction ($F = 0.301$, $p = 0.590$). Q-LES-Q mean score and standard deviation data presented in Table 26. Graphical representation of the Q-LES-Q mean scores presented in Figure 5.

Table 26: Q-LES-Q Pre-test/Post-test Scores (Mean Scores and Standard Deviations)

Group	Pre-Test	Post-Test
Exercise Intervention	45.31 (10.36)	47.92 (9.43)
Social Control Group	38.75 (6.96)	43.5 (10.14)
Total	42.81 (9.59)	46.24 (9.71)

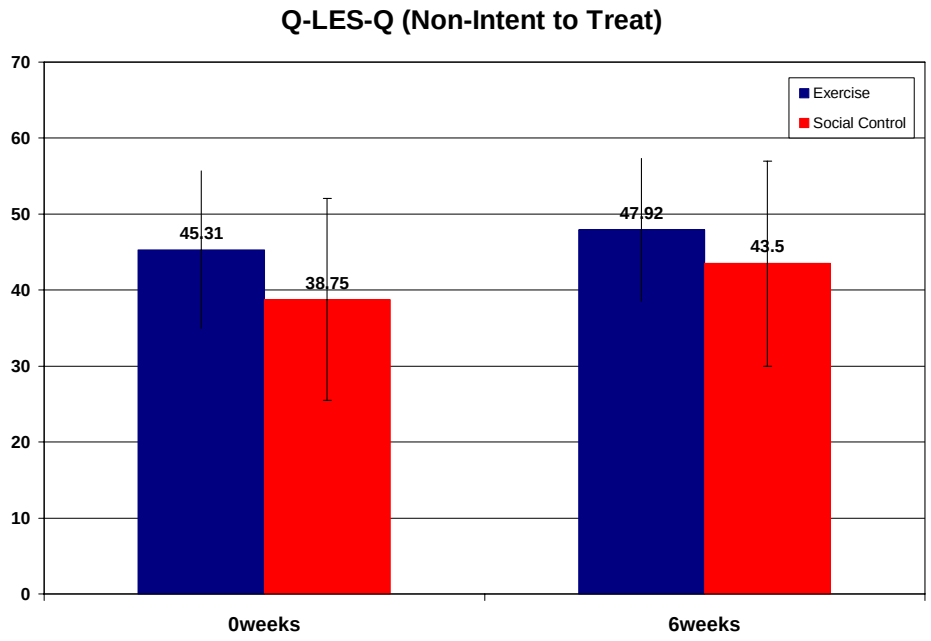

Figure 5: Q-LES-Q Mean Scores for the Non-Intent-to-Treat-Two-Way-ANOVA Analysis

4.3.5 REVISED UCLA LONELINESS SCALE

An independent t test was used to compare initial group differences for the Revised UCLA Loneliness Scale between the group exercise intervention and the social control group

(stress coping intervention). This was done to verify that the randomization process was done appropriately and that both groups displayed homogeneity. No significant differences existed between the two groups for the Revised UCLA Loneliness Scale at 0-week ($t = -1.256$, $p = 0.224$). Initial pre-test data for the Revised UCLA Loneliness Scale presented in Table 27.

Table 27: Revised UCLA Loneliness Scale Pre-test (Mean Scores and Standard Deviations)

Group	Pre-Test
Exercise Intervention	42.85 (9.57)
Social Control Group	48.25 (9.57)

A two-way, repeated measures ANOVA was used to determine mean differences in the Revised UCLA Loneliness Scale scores between the group exercise intervention and the social control group across the 6-week intervention. No significant main effect for time ($F = 2.96$, $p = 0.102$) or for time by group interaction ($F = 2.575$ $p = 0.125$) was found. The Revised UCLA Loneliness Scale mean score and standard deviation data presented in Table 28. Graphical representation of the Revised UCLA Loneliness Scale mean scores presented in Figure 6.

Table 28: Revised UCLA Loneliness Scale- Pre-test/Post-test Scores (Mean Scores and Standard Deviations)

Group	Pre-Test	Post-Test
Exercise Intervention	42.85 (9.57)	42.62 (11.58)
Social Control Group	48.25 (9.57)	41.63 (10.8)

Total	44.9 (9.7)	42.24 (11.02)

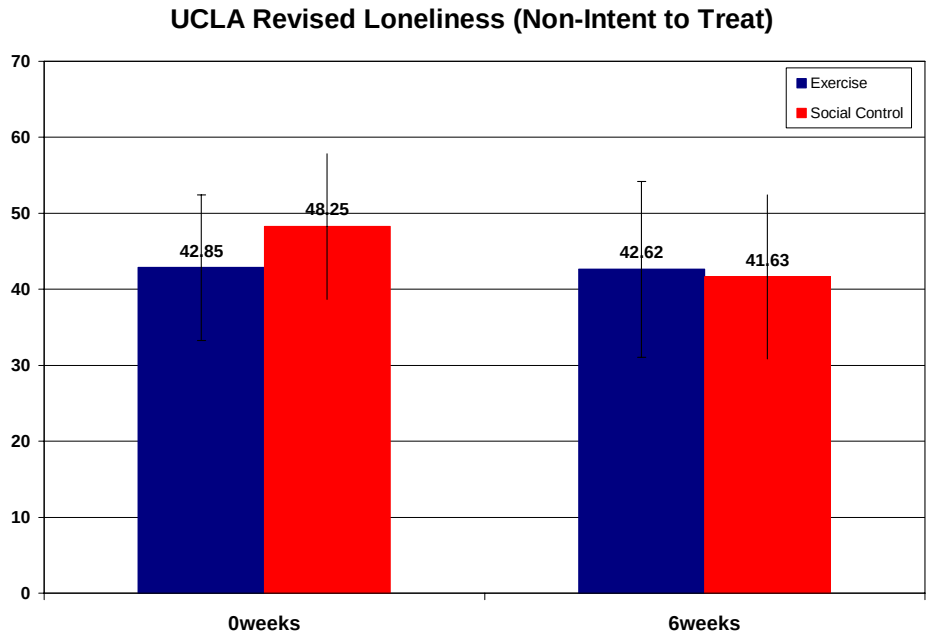

Figure 6: Revised UCLA Loneliness Scale Mean Scores for the Non-Intent-to-Treat-Two-Way-ANOVA Analysis

4.3.6 POSSIBLE CONFOUNDERS

As in the intent-to-treat analysis, a two-way repeated measures ANOVA was extended to determine the aforementioned possible confounders that may have contributed to test or group differences on the IDS-SR, Q-LES-Q (short form), and the Revised UCLA Loneliness Scale for the non-intent-to-treat analysis. Results are described below. Mean scores and standard deviations are presented only for confounders that resulted in a significant finding and can be found in APPENDIX M.

4.3.6.1 GENDER

Results indicated that a time by gender interaction ($F = 6.430$, $p = 0.021$) for the Q-LES-Q was found. Results also indicated that no time main effect, time by gender interaction, or time by group interaction occurred with any of the other dependent variables ($p > 0.05$).

4.3.6.2 AGE

As a potential confounder, age did not result in a time main effect, time by age interaction, or time by group interaction on any dependent variable ($p > 0.05$).

4.3.6.3 ETHNICITY

A time main effect for the Revised UCLA Loneliness Scale was found for ethnicity ($F = 16.590$, $p = 0.001$). Additionally, a time by ethnicity interaction occurred on the Revised UCLA Loneliness Scale ($F = 12.664$, $p = 0.002$). No time main effect, time by ethnicity, or time by group interaction occurred with the other dependent variables ($p > 0.05$).

4.3.6.4 MARITAL STATUS

As a potential confounder, marital status did not result in a time main effect, time by marital interaction, or time by group interaction on any dependent variable ($p > 0.05$).

4.3.6.5 EDUCATION LEVEL

A time by education interaction was found for the Q-LES-Q ($F = 4.978$; $p = 0.039$) and the Revised UCLA Loneliness Scale ($F = 5.140$, $p = 0.036$). No time main effect or time by group interaction existed for the other dependent variables ($p > 0.05$).

4.3.6.6 OCCUPATION

Results indicated a time main effect ($F = 13.911$, $p = 0.002$) and a time by occupation interaction ($F = 9.640$, $p = 0.006$) for the Revised UCLA Loneliness Scale. No other time main effect, time by occupation interaction, or time by group interaction occurred or the other dependent variables ($p > 0.05$).

4.3.6.7 ANNUAL INCOME

Results indicated a time by annual income occurred for the IDS-SR ($F = 7.909$, $p = 0.012$) As a potential confounder, annual income did not result in a time main effect, time by annual income interaction, or time by group interaction for the other dependent variables ($p > 0.05$).

4.3.6.8 DURATION OF ILLNESS

A time main effect for duration of illness on the Revised UCLA Loneliness Scale resulted ($F = 4.893$, $p = 0.040$). Duration of illness did not result in a time main effect, time by duration of illness interaction, or duration of illness by group interaction on any other dependent variable ($p > 0.05$).

4.3.6.9 SEVERITY OF ILLNESS

No time main effect, time by severity of illness interaction, or severity of illness by group interaction occurred for any of the dependent variables ($p > 0.05$).

4.4 MODIFIABLE ACTIVITY QUESTIONNAIRE

The Modifiable Activity Questionnaire was used to assess baseline physical activity level and, primarily, to assess if any changes in activity level occurred over the course of the intervention. Specifically, it was important to verify that physical activity levels did not increase for those randomized to the social control group during study participation as this would have biased the results. The questions within the questionnaire were not quantifiable, and thus it was not possible to perform a statistical analysis. However, subjects within the social control group were asked to review their baseline questionnaires and report any changes in physical activity levels. No subject in the social control group reported any change in physical activity level from baseline to termination of the study.

4.5 INSTRUCTOR EVALUATIONS

Instructor evaluations were completed by subjects at the conclusion of the study to verify that the intervention instruction was comparable for all groups, thereby reducing the likelihood that the results were influenced by the relationship between the instructor and subjects. A total of 16 subjects completed the instructor evaluations (9 for the exercise group and 7 for the social control group). The average score for the exercise instructor was 4.8 (5 = excellent). Three different stress coping instructors were used to conduct three separate stress coping interventions during the time required to complete the study. Time constraints for the stress coping instructors made it unavoidable to use only one instructor. The average score for stress coping instructor #1 was 4.7 (n = 3), 5.0 for stress coping instructor #2 (n = 1), and 4.7 for stress coping instructor #3 (n = 3). Although a statistical analysis for the instructor evaluations was not performed due to the small sample, the evaluation ratings were similar between instructors.

5 DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Depression is one of the most serious psychophysiological illnesses affecting nearly 19 million U.S. adults each year. It is associated with severe mental, emotional, physical, and behavioral disruptions, resulting in pain, suffering, and disability (Mayo Clinic, 2001). Depression ranks only second behind heart disease for years of life lost due to disability or premature death. The economic burden associated with depression and health care costs has increased from $43 billion to $80 billion between 1990 and 2000 (Greenberg et al., 2003). Depression has also been identified as one of the primary contributors to the global burden of disease, resulting in increased efforts to improve depression prevention and treatment programs (Mayo Clinic 2001).

Although standardized treatment of depression, including anti-depressant medication and/or psychotherapy, has been recognized as an effective treatment modality, it has been estimated that 30% - 35% of individuals do not respond to anti-depressant medication (Blumenthal et al., 1999). Additionally, 20% - 59% of individuals prescribed antidepressant medications stop taking them within the first 3 weeks (Lawlor and Hopker, 2001). This may be a result of the side-effects of nausea, diarrhea, insomnia, anxiety, constipation, and weight gain, as well as the high "out of pocket" expenses that may be associated with these medications (Blumenthal et al., 1999). Even more disconcerting is that only 30% of people with depression seek treatment (Shapiro et al. 1984) and only 10% receive adequate treatment (Hirschfeld et al. 1997). The social stigma of being diagnosed with a "mental" disorder may discourage depressed individuals from seeking medical treatment (Robins et al., 1991). As a result, efforts have been made to identify alternative or complimentary forms of treatment.

Of particular interest, exercise has been examined for its possible role in the treatment of depression. Experimental studies, meta-analyses, and research reviews have indicated that exercise is an appropriate and successful treatment modality for depression that can be recommended for most individuals with no negative side effects, little or no cost, and without a social stigma. These studies have shown that aerobic and non-aerobic exercise is more effective than placebo conditions or no treatment conditions and is comparable to the standardized treatment programs of anti-depressant medication and/or psychotherapy (Greist et al., 1979; McMann and Holmes, 1984; Klein et al., 1985; Fremont and Craighead, 1987; Martinsen et al., 1989; Singh et al. 1997; Blumenthal et al., 1999; Babyak et al., 2000; North, McCullagh, and Tran, 1990; Bryne and Bryne, 1993; Martinsen, 1990, 1994; Lawlor and Hopker, 2001). Exercise has also been successful in decreasing symptoms of depression when used in conjunction with standard treatment modalities (Dimeo et al., 2001 and Mather et al. 2002).

Therefore, the purpose of this investigation was to evaluate the influence of a 6-week group exercise intervention in the adjunctive treatment of depression. Thirty-one subjects were recruited from WPIC's Bellefield Clinic of the Adult Service Line and the surrounding community. Subjects were between the ages of 25 and 60 years and previously diagnosed with depression (dysthymic disorder, major depressive disorder, depressive disorder not otherwise specified, or bipolar disorder), according to the DSM-IV by a licensed therapist. All subjects were enrolled in a standardized treatment program consisting of antidepressant medication and psychotherapy. Subjects were randomly assigned to either a 6-week group exercise intervention or a social control group (stress coping intervention). Groups were matched for group exposure, meeting for one hour, two nights a week. The IDS-SR was used to assess changes in depressive symptoms as a result of the intervention at 0 and 6-weeks. Additionally, the Q-LES-Q and the

Revised UCLA Loneliness Scale were used to assess changes in quality of life and feelings of loneliness, respectively, as a result of the intervention at 0 and 6-weeks. The main hypothesis was that subjects randomized to the group exercise intervention would experience a significant decrease in depressive symptoms, as assessed by the IDS-SR, and a significant increase in quality of life, as assessed by the Q-LES-Q, when compared to the social control group. An additional hypothesis was that subjects in the group exercise intervention and the social control group would experience a significant and equal decrease in feelings of loneliness as assessed by the Revised UCLA Loneliness Scale. Statistical analysis included independent t-tests to verify group homogeneity following randomization on the IDS-SR, Q-LES-Q, the Revised UCLA Loneliness Scale, and physical characteristics, as well as separate two-way (group x time) repeated measures ANOVA to determine between and within group mean differences on the aforementioned questionnaires. In addition, separate two-way repeated measures ANOVA were extended to examine gender, age, ethnicity, marital status, education level, occupation, annual income, duration and severity of illness as possible confounders.

5.1 PRIMARY VARIABLE - DEPRESSIVE SYMPTOMS

It was hypothesized that the group exercise intervention would demonstrate a statistically significant improvement in depressive symptoms when compared to the social control group (stress coping intervention). The results for both the intent-to-treat analysis and the non-intent-to-treat analysis indicated a significant decrease in depressive symptoms for the group exercise intervention and the social control group.

Although it was expected that a decrease in symptoms of depression would occur for the exercise intervention, these same findings for the social control group were not expected. It was concluded that social interaction/support may have been a confounding factor in the outcome of

this study. Individuals with depression are predisposed to feelings of social isolation and do not feel that they have the support needed to recover from the illness. Symptoms such as depressed mood, diminished interest or pleasure in daily activities, hypersomnia, loss of energy, feelings of lethargy, and psychomotor agitation can contribute to lack of involvement in daily and social activities. Family, friends, and work colleagues may also be unsympathetic, inpatient, and unwilling to understand the complexity of the illness and the recovery furthering the feelings of social isolation. Participation in group activities, such as an exercise group, may help to provide personal contact and decrease these feelings of isolation (Buckworth and Dishman, 2002). Subjects from both groups in the current study indicated a sense of "normalcy" and belonging as they were able to interact with people who could identify, understand, and relate to their experiences associated with depression. The subjects served as an internal support system for one another which may have helped them to deal with the daily struggle of their illness.

Similarly, McNeil et al. (1991) conducted a study investigating the effects of exercise on depressive symptoms in moderately depressed elderly. Males and females (mean age = 72.5) were randomly assigned to either a 6-week walking group, a social control contact condition, or a wait-listed control group. Subjects assigned to the exercise group walked for 20 minutes with the duration increasing to 40 minutes over a 6-week duration. A research assistant accompanied subjects during two walking sessions and one walking session was undertaken alone without any supervision. The social control contact condition consisted of home visits and casual conversation by a research assistant 2 days a week. The results from this study indicated a reduction in depressive symptoms for the walking group and the social control contact group. The authors concluded that the social aspect of the conditions may have been partly responsible for the reduction in depressive symptoms in both groups.

Additionally, other studies investigating the effects of exercise in the treatment of depression have found that exercise is a viable form of treatment, however, these studies also have not been able to demonstrate that exercise alone is responsible for the therapeutic effect. In fact, these researchers caution that the positive influence of social interaction on their results can not be overlooked.

Doyne et al. (1987) compared running to weight lifting exercises in the treatment of depression. Subjects (all women) between the ages of 18-35 years were randomly assigned to a running group, a weight lifting group, or a wait-listed control group. Subjects assigned to the running group were instructed to walk or run around a 1/8 mile indoor track at an intensity equivalent to 80% of estimated work capacity. Subjects assigned to the weight lifting group participated in a standard 10-station weight training program. At the end of 8-weeks, results indicated that both exercise conditions significantly reduced symptoms of depression when compared to the wait-listed control group as assessed by the BDI and the HRSD. The authors concluded that both types of exercise were effective in decreasing symptoms of depression. The authors also noted that the impact of regular, personal contact between the research staff and exercise groups on the study results could not be determined. The authors suggested that a non-exercise control group with comparable social contact experiences could help to differentiate between the effects of exercise and social contact on symptoms of depression.

Martinsen et al. (1989) compared aerobic and non-aerobic group exercise regimes in the treatment of clinical depression (i.e. major depressive disorder, dysthymic disorder, and depressive disorder not otherwise specified). Subjects assigned to the aerobic exercise group participated in walking/jogging at approximately 70% of maximum aerobic capacity. Subjects assigned to the non-aerobic exercise group participated in muscular strength, flexibility, and

relaxation exercises. Both groups exercised for 60 minutes, 3 days per week for a total of 8 weeks. The results indicated an equal decrease in depressive symptoms in both groups as assessed by the BDI. The authors concluded that both aerobic and non-aerobic exercise was effective in decreasing symptoms of depression. However, a non-exercise social control group was not included and all exercise sessions were administered in a group format. Therefore, it was difficult to conclude that exercise per se was effective in decreasing symptoms of depression as social interaction may have influenced the results of this study.

Blumenthal et al.(1999) examined the effects of exercise training on older patients (aged $\geq$ 50 years) with major depression. Subjects were randomly assigned to one of three groups: 1) exercise intervention, 2) anti-depressant medication or, 3) a combination of exercise and anti-depressant medication. Subjects assigned to the exercise intervention attended 3 supervised exercise sessions (30 continuous minutes of walking or jogging at 70% to 80% of heart rate reserve) per week for 16 weeks. Subjects assigned to the anti-depressant medication group received sertraline, a selective serotonin reuptake inhibitor, and subjects assigned to the combination group received both the exercise intervention and the aforementioned anti-depressant medication. Results indicated that groups did not differ statistically on the HAM-D or BDI scores at the end of 16 weeks and that all groups experienced a statistically significant decrease in depressive symptoms. The authors concluded that an exercise training program should be considered an alternative treatment modality for older individuals with a diagnosis of depression. However, it is important to point out that this study failed to control for social interaction. In fact, the authors noted that social interaction may have contributed to the positive results experienced in the exercise group. The authors recommended that future investigations involving exercise and depression should control for the level of social involvement by

examining the effects of the exercise setting on response to treatment, such as comparing home and group based exercise programs.

More recently, Dunn et al. (2005) conducted a 12 week study investigating the efficacy and dose response of exercise treatment for mild to moderate major depressive disorder. Subjects between the ages of 20 to 45 years were randomized to 1 of 5 groups:

1. A "low dose" exercise group: 3 days/week with a 7 kcal/kg/week caloric expenditure of aerobic exercise performed on a treadmill or stationary bicycle
2. A "low dose" exercise group: 5 days/week with a 7 kcal/kg/week caloric expenditure of aerobic exercise performed on a treadmill or stationary bicycle
3. A "public health dose" group: 3 days/week with a 17.5 kcal/kg/week caloric expenditure of aerobic exercise performed on a treadmill or stationary bicycle
4. A "public health dose" group: 5 days/week with a 17.5 kcal/kg/week caloric expenditure of aerobic exercise performed on a treadmill or stationary bicycle
5. A exercise placebo group: 3 days/week of stretching flexibility exercises for 15 to 20 minutes per session

Results indicated a significant main effect for energy expenditure in reducing symptoms of depression as assessed by the HRSD17 at the end of 12 weeks. Specifically, it was concluded that subjects expending more energy during exercise experienced a greater decrease in depressive symptoms. However, again, this study did not control for social interaction as all exercise sessions were supervised. The authors stated that social support may have contributed to the reduction in depressive symptoms.

Results of the current investigation, along with previous research, indicate that exercise interventions may have a positive impact on symptoms of depression. However, the extent to

which social interaction or support contributes to this outcome is unknown. Further research specifically designed to evaluate the influence of exercise on depressive symptoms is warranted. It is important to determine how exercise and/or social interaction/support may influence the positive prognosis of depressive symptoms.

5.2 INFLUENCE OF CONFOUNDERS ON DEPRESSIVE SYMPTOMS

Homogeneity of group assignment was evaluated using an independent t-test to verify appropriate randomization of subjects and to determine if subject characteristics were similar between the two groups. No differences were found in the demographic or physical characteristics of the groups. In addition to the statistical analysis for the main dependent variables, a 2-way repeated measures ANOVA was also performed to examine the interaction of possible confounders and their influence on depressive symptoms. Possible confounders included gender, age, ethnicity, marital status, education level, occupation, annual income, duration and severity of illness. Results indicated that gender and annual income may have been possible confounders on depressive symptoms.

Although a significant gender by time interaction was not found, further examination of the data led to the conclusion that a gender response on the IDS-SR may have impacted the results. Male subjects within the social control group demonstrated a 33.3% decrease for the intent-to-treat analysis and 54% decrease for the non-intent-to-treat analysis in depressive symptoms following the 6-week intervention. Male subjects within the group exercise intervention demonstrated a 13.5% (intent) and a 20% (non-intent) decrease in depressive symptoms. Comparatively, females within the social control group and group exercise intervention exhibited a 9.4% (13% - non-intent) and 1.2% (2% - non-intent) decrease, respectively, in depressive symptoms. It is possible that the magnitude of change for the male

subjects in the social control group contributed, in part, to the lack of significance between the two groups. However, the small number of males in the social control group limited the power of this analysis.

Additionally, annual income for the non-intent-to-treat analysis indicated a time by income interaction. Despite the significant interaction, the interpretation of the data is not possible given the insufficient sample size within each income bracket (APPENDIX N and O)

5.3 SECONDARY VARIABLES – QUALITY OF LIFE AND FEELINGS OF LONELINESS

It was hypothesized that subjects randomized to the group exercise intervention would demonstrate a statistically significant improvement in quality of life when compared to those randomized to the social control group. It was also hypothesized that subjects randomized to the group exercise intervention and the social control group would demonstrate a significant and equal decrease in feelings of loneliness. Results of this study did not support the proposed hypothesis for either quality of life or feelings of loneliness as no significant differences in either quality of life or feelings of loneliness were found.

The lack of significant findings for quality of life, noted presently, was not expected. Previous research has indicated that exercise interventions improve quality of life in a number of populations, including depression. The failure of the exercise group intervention to result in a greater improvement in quality of life than observed in the social control group may have been a result of variability on the Q-LES-Q scores. A large difference in the variability of the Q-LES-Q was noted between males and females. Percent changes in standard deviations associated with the initial measurement for males within the social control group were 75.6% (intent) and 0.0% (non-intent) greater than post-test values. A 1.1% (intent) and a 77.2% (non-intent) difference

were observed in males within the group exercise intervention for the initial and final measures, respectively. Comparatively, females within the social control group and the group exercise intervention demonstrated a 10.3% (intent), 19.2% (non-intent), 2.1% (intent) and a 7.7% (non-intent) difference, respectively, between pre-test and post-test standard deviations. The combined variability of quality of life for male subjects and the small sample size may have influenced the outcome of this variable and prohibited significant findings.

Additionally, males within the social control group experienced a 22.2% improvement in quality of life as compared to a 9.0% improvement for males within the group exercise intervention for the intent to treat analysis. The non-intent-to-treat analysis indicated a 50.4% increase in quality of life for males in the social control group and a 13.5% increase for those in the group exercise intervention. Comparatively, females within the social control group and the group exercise intervention demonstrated a 0.0% (intent), 0.0% (non-intent), 2.5% (intent) and a 2.8% (non-intent) difference, respectively, between pre-test and post-test standard deviations. Although there were comparatively large changes in the male mean scores for quality of life, the variability associated with this measure, again, may have prevented statistical significance from occurring.

The lack of significant findings for feelings of loneliness is also somewhat surprising considering the fact that both groups experienced a significant decrease in depressive symptoms that may have resulted from the social support/interaction. Although the IDS-SR and the Revised UCLA Loneliness Scale have not been used simultaneously in previous exercise and depression research, an inverse relationship between the two may have been expected. Specifically, subjects within a group intervention by virtue of the social support/interaction would not only have experienced a decrease in the symptoms of depression but also feelings of

loneliness. The present results may have been influenced by the variability of subject scores within the social control group. Initial standard deviations for males within the social control group were 64.9% (intent) and 59% (non-intent) greater than post-test scores as compared to a 28.8% (intent) and a 16% (non-intent) difference in males within the group exercise intervention. Females within the social control group and the group exercise intervention demonstrated a 14.7 % (30% - non-intent) and 15.6% (50% - non-intent) difference, respectively, between pre-test and post-test standard deviations. The greater variability in standard deviation scores and the small sample size may have diminished the likelihood of achieving significance with this variable. On the other hand, it is possible that a relationship between these variables does not exist and that loneliness and depressive symptoms should be considered independent of one another.

In summary, although the initial analysis demonstrated homogeneity between the groups and a lack of gender by time interaction for the dependent variables, a gender response seems likely to have occurred. It appears male subjects in the social control group responded more favorably to the intervention when compared to males in the group exercise intervention and females in both groups.

5.4 INFLUENCE OF CONFOUNDERS ON QUALITY OF LIFE AND FEELINGS OF LONELINESS

Homogeneity of group assignment was evaluated using an independent t-test to verify appropriate randomization of subjects and to determine if subject characteristics were similar. No group differences were found. In addition to the main analysis for the dependent variables, a separate 2-way repeated measures ANOVA was also performed to examine the interaction of possible confounders and their influence on quality of life and feelings of loneliness.

Results for the intent-to-treat and non-intent-to-treat analysis indicated a time main effect for feelings of loneliness for the confounder of ethnicity. This indicated that when accounting for ethnicity, pre-test scores differed from post-test scores for the group exercise intervention and the social control group. Although the main analysis did not support a significant change for feelings of loneliness, the response to the intervention may be more influential for different ethnicities. Additionally, the non-intent-to-treat analysis indicated a time by ethnicity interaction. This indicated that although all ethnic groups decreased feelings of loneliness, African-Americans were able to decrease their feelings of loneliness greater than any other ethnic group.

The intent-to-treat and non-intent-to-treat analysis also indicated the following:

Intent-To-Treat-Analysis:

- A time by education interaction for quality of life and feelings of loneliness
- A time main effect and a time by occupation interaction for feelings of loneliness
- A time main effect and time by severity of illness interaction for the Rating of Overall Quality of Life question (separate question on the Q-LES-Q)

Non-Intent-To-Treat-Analysis:

- A time by education interaction for quality of life and feelings of loneliness
- A time main effect and a time by occupation interaction for feelings of loneliness
- A time main effect for duration of illness for feelings of loneliness
- A time main effect and time by severity of illness interaction for the Rating of Overall Quality of Life question (separate question on the Q-LES-Q)

Although interactions were found for the aforementioned confounders, interpretation of these results are difficult due to the inter-subject variability and the sample size for each level, as some levels within each confounding variable were represented by a single or no subject.

5.5 LIMITATIONS

Several limitations may have contributed to the results of the current study. Recruitment of subjects was actively performed over a period of 18 months which resulted in only 31 eligible and willing subjects. Factors that may have influenced the difficulty in recruitment included strict eligibility criteria, extensive time commitment of the participant, lack of monetary remuneration, and lack of subject referrals from patient therapists. Recruitment appears to be a common limitation in clinical interventions investigating exercise in the treatment of depression. Mather et al. (2002) reported a total of 1,885 patients were considered for participation in their exercise intervention. However, less than 5% were eligible and randomized. Additionally, Dunn et al. (2005) reported pre-screening 1,664 potential subjects before 80 (4.8%) individuals could be randomized for participation in their exercise intervention. This suggests that recruitment for such studies is challenging and therefore may require creative recruitment procedures and the firm commitment of clinical personnel to ensure subject participation.

Adherence also continues to remain a common limitation in depression and exercise related research. The adherence rate for the current study was 68%, which was lower than previously published adherence rates for exercise treatment of depression (75%-85%) (Blumenthal et al., 1999), but consistent with adherence rates for anti-depressant medication (60%-80%) (Dunn et al. 2005). Low adherence rates support the notion that exercise interventions must be targeted towards the individuals of interest, keeping in mind the common

participatory barriers for those with depression, such as current symptomatic status. Exercise interventions, therefore, must be creative and motivating.

In addition, the small number of subjects initially recruited for the current project was insufficient to provide replacements for drop-outs. As such, the reduction in the total number of subjects adversely affected the power of the study. Ideally, a larger pool of potential subjects would have allowed for drop-outs to be replaced and thereby maintaining statistical power.

Furthermore, potential unexpected daily and life experiences, such as treatment changes, career changes, divorce, financial worries, injuries, and death may also have influenced responses on the questionnaires and the results of the study. Such events were impossible to control, however they represent the experiences and challenges that individuals with depression encounter on a daily basis. Although these experiences were uncontrollable, they may have added to the strength of the study design as it was conducted in a real-life setting.

As a result of the recruitment challenges and the low adherence rate, the results of this study demonstrated an effect size change of 0.43 and a power 0.435 for the IDS-SR. Similarly, the Q-LES-Q, and the Revised UCLA Loneliness Scale demonstrated an effect size change of 0.55 and 0.63 and a power of 0.48 and 0.519, respectively. Based on the current results, a total of 100 subjects would have been needed to demonstrate a power of 0.80 for a group by time interaction to determine exercise as the main contributor to a decrease in depressive symptoms and feelings of loneliness, as well as an improvement in quality of life.

5.6 SPECIAL CONSIDERATIONS

It is plausible that social support/interaction may have contributed to the results of the present study. However, it is also important that these results are not misinterpreted. It should not be suggested that exercise in the adjunctive treatment of depression is no more beneficial

than social support/interaction. Instead, social support/interaction should be considered as one piece of the complex "treatment puzzle" of depression. Additionally, the social support/interaction theory has not been adequately validated in well-designed studies specific to exercise in the treatment of depression and it does not explain the prevalence of research advocating the use of exercise as an effective treatment modality.

Further supporting the use of exercise in the treatment of depression is the fact that individuals with depression are at a higher risk for diseases, such as cardiovascular disease and diabetes. In fact, depression is recognized as a secondary risk factor for cardiovascular disease. More importantly, physical inactivity, which is often a symptom of depression, is a primary risk factor for cardiovascular disease. Exercise is a well-established prevention and treatment tool for such diseases, and as a result should be considered a part of an overall treatment program for those with depression (ACSM, 2005). Despite the quantitative evidence resulting from this study, the prescription of exercise is warranted to retard the psychological and physiological risk factors associated with disease.

5.7 STATISTICAL SIGNIFICANCE VERSUS CLINICAL SIGNIFICANCE

Results of the present investigation indicated a statistically significant decrease in feelings of depression as assessed by the IDS-SR in the exercise intervention and the social control group. However, it is important to realize that a statistically significant finding does not necessarily translate into clinical significance. Clinical significance is often defined as at least a 50% reduction in depression symptoms. Specific to the IDS-SR, a score of 12 or below is considered clinically significant. In the present investigation, out of 21 subjects who completed the study only 4 subjects scored 12 or below at the end of the intervention (3 in the exercise group and 1 in the social control group). This resulted in less than 5% of subjects reaching clinical significance.

Although the groups as a whole may have experienced a decrease in symptoms of depression, individually and clinically, 95% of the subject scores on the IDS-SR remained high. These high scores indicate the fragile state of those with depression, as well as the difficulty in treating those with depression. Individual subject scores are listed in APPENDIX N.

5.8 CONCLUSIONS

The purpose of this study was to investigate the influence of a group exercise intervention in the adjunctive treatment (in combination with standardized treatment consisting of antidepressant medication and psychotherapy) of depression. It was hypothesized that subjects randomized to the exercise group intervention would have a significant decrease in depressive symptoms, as assessed by the IDS-SR, and a significant increase in quality of life, as assessed by the Q-LES-Q when compared to subjects randomized to the social control group (stress coping intervention). It was also hypothesized that subjects in both the group exercise intervention and the social control group would experience a significant and equal decrease in feelings of loneliness, as assessed by the Revised UCLA Loneliness Scale. However, results from this study did not support the proposed hypotheses. Results indicated that subjects in the group exercise intervention and the social control group experienced a decrease in symptoms of depression, whereas no significant differences in either group for quality of life or feelings of loneliness were found. Results were the same for the intent-to-treat analysis and the non-intent-to-treat analysis. It was concluded that social interaction may have contributed to the positive findings concerning symptoms of depression.

Although the findings of this study did not support the proposed hypotheses, caution in the interpretation of these results is warranted. While previous research has proposed that social support may play a role in decreasing symptoms of depression, it should be considered only one

part of a treatment program. It is still important to consider the positive impact that exercise may play in the treatment of depression. It is also important to consider that the results of the present investigation may have been largely influenced by research limitations, such as the recruitment, adherence to participation, small sample size, and variability in the individual subject response to the interventions.

5.9 RECOMMENDATIONS

Research investigating the role exercise may play in the treatment of depression is not a novel idea. Previous research has consistently supported the use of exercise to decrease symptoms of depression (Greist et al., 1979; McMann and Holmes, 1984; Klein et al., 1985; Fremont and Craighead, 1987; Martinsen et al., 1989; Singh et al. 1997; Blumenthal et al., 1999; Babyak et al., 2000; North, McCullagh, and Tran, 1990; Bryne and Bryne, 1993; Martinsen, 1990, 1994; Lawlor and Hopker, 2001). In fact, many depression treatment facilitators have recently started to acknowledge the benefits of exercise and are now recommending it to their patients as part of the treatment program (Mayo Clinic, 2001). Although the results of this study did not support the proposed hypotheses, further research investigating the inclusion of an exercise intervention in the treatment of depression is still warranted. However, research in this area should be expanded to investigate new initiatives, such as those described below.

Over 60% of the American population does not engage in regular activity and it has been proposed that this number may be higher in those with depression. Recent research has focused a great deal on identifying common barriers to exercise in the non-depressed population and exercise interventions have been designed to help overcome these barriers (ACSM, 2005). Developing strategies to overcome barriers to exercise may facilitate the adoption of regular

activity. However, this has not been an easy task and may be even harder for those with depression.

Therefore, the primary focus of future research should deal with the "how" of exercise and depression. It is important to investigate how to motivate a depressed individual with symptoms such as lethargy, lack of energy, disinterest in regular activities, and the inability to "get up and do something" to adopt exercise as part of their treatment program. The question remains as to whether this is even possible or at what time exercise should be introduced to a person being treated with depression. Research should investigate these types of questions, as well as how to overcome these common barriers to exercise. Given the unique challenge associated with patients with depression, it is critical to generate creative and motivational approaches when designing exercise interventions/programming to improve adherence to such programs.

Additional research should also investigate whether a dose-response relationship exists between exercise and depressive symptoms. These research initiatives should examine the most appropriate frequency, duration, and intensity of exercise for those with depression. It is important to determine how much or how little of an exercise stimulus is needed in order to elicit a positive change in depressive symptoms given the fact that the common symptoms of depression can be a barrier to how much exercise will be performed. Dunn et al. (2005) recently conducted a dose response study for exercise treatment and depression (the specifics of the study have been discussed previously). Results indicated that subjects performing aerobic exercise 5 days per week and with higher caloric expenditures had a larger decrease in depressive symptoms when compared to subjects performing aerobic exercise 3 days a week and with a lower caloric expenditure. However, the adherence rates for subjects participating in aerobic exercise 3 days per week averaged 78% compared to 65% for those exercising 5 days per week.

This may indicate that although higher amounts of exercise may be more beneficial in reducing symptoms of depression, the reality of higher loads of exercising been performed by those with depression remains questionable.

Also, research may want to investigate the role that exercise modality plays in the treatment of depression. It is possible that individuals participating in an exercise intervention may not enjoy the particular modality being offered in the intervention. If this is the case, most likely, the results of the investigation would be compromised making it difficult to see a true benefit of the exercise intervention. Therefore, future research may need to be sensitive to this issue and offer types of exercise that each individual would enjoy.

Moreover, future research investigating the effectiveness of exercise in the treatment of depression should control for social interaction/support. Given the fact that the lack of inclusion of an appropriate control group is a common limitation in previous research, the question concerning the true effect of exercise in decreasing depressive symptoms remains unanswered. Future research including the use of a social control group to study the effects of a group exercise intervention in the treatment of depression must also be diligent in creating equally engaging social environments between groups. Individuals with depression that are participating in a group exercise session may not experience the social dynamics as they would in a social control group. Individuals participating in an exercise group may be focused on the exercises at hand rather than engaging the other participants, thus compromising social interaction. This may create an imbalance in the social contact between groups making it difficult to identify the positive influence of the exercise intervention. Therefore, establishing intervention programs that properly control for social interaction will allow research to separate the effects of exercise from the effects of social interaction/support in order for this question to be answered.

Furthermore, previous research has focused primarily on the use of exercise in the treatment of unipolar depression. Currently, little is known about the antidepressant effects of exercise on a bipolar population. The diagnosis of bipolar disorder is typically regarded as exclusion criteria in most exercise studies. It has been hypothesized that individuals diagnosed with bipolar disorder will not respond to an exercise intervention, as this disorder is predominantly influenced by genetics. However, this hypothesis has not been tested and as a result, the efficacy of exercise in the treatment of this disorder has not been established. As such, research examining the effect of exercise in the treatment of bipolar disorder is also warranted.

Lastly, research should focus on investigating the effectiveness of exercise in the treatment of depression as part of a multidisciplinary approach. Previous research investigating the effectiveness of exercise in the treatment of depression has focused on comparing exercise to other standard types of treatment, such as anti-depressant medication and/or psychotherapy (Greist et al., 1979; McMann and Holmes, 1984; Klein et al., 1985; Fremont and Craighead, 1987; Martinsen et al., 1989; Singh et al. 1997; Blumenthal et al., 1999; Babyak et al., 2000). However, given the fact that the etiology and the treatment of depression are multidimensional, exercise should be included as one part of a treatment strategy. It is important to refrain from the "one size fits all" treatment mentality so that an individual suffering from depression has the opportunity to benefit from a variety of treatment modalities and thus improving the ability to overcome the illness.

APPENDICES

APPENDIX A

THE INVENTORY OF DEPRESSIVE SYMPTOMATOLOGY – SELF REPORT

INVENTORY OF DEPRESSIVE SYMPTOMATOLOGY- SELF-REPORT

1. Falling Asleep:
    a. I never take longer than 30 minutes to fall asleep
    b. I take at least 30 minutes to fall asleep, less than half the time
    c. I take at least 30 minutes to fall asleep, more than half the time
    d. I take more than 60 minutes to fall asleep, more than half the time

2. Sleep During the Night:
    a. I do not wake up at night
    b. I have a restless, light sleep with a few brief awakenings each night
    c. I wake up at least once a night but I go back to sleep easily
    d. I awaken more than once a night and stay awake for 20 minutes or more, more than half the time

3. Waking Up Too Early:
    a. Most of the time, I awaken no more than 30 minutes before I need to get up
    b. More than half the time, I awaken more than 30 minutes before I need to get up
    c. I almost always awaken at least one hour or so before I need to, but I go back to sleep eventually
    d. I awaken at least one hour before I need to, and can't go back to sleep

4. Sleeping Too Much:
    a. I sleep no longer than 7-8 hours/night, without napping during the day
    b. I sleep no longer than 10 hours in a 24-hour period including naps
    c. I sleep no longer than 12 hours in a 24-hour period including naps
    d. I sleep longer than 12 hours in a 24-hour period including naps

5. Feeling Sad:
    a. I do not feel sad
    b. I feel sad less than half the time
    c. I feel sad more than half the time
    d. I feel sad nearly all the time

6. Feeling Irritable:
    a. I do not feel irritable
    b. I feel irritable less than half the time
    c. I feel irritable more than half the time
    d. I feel extremely irritable nearly all of the time

7. Feeling Anxious or Tense:
    a. I do not feel anxious or tense
    b. I feel anxious (tense) less than half the time
    c. I feel anxious (tense) more than half the time
    d. I feel extremely anxious (tense) nearly all of the time

8. Response of Your Mood to Good or Desired Events:
    a. My mood brightens to a normal level, which lasts for several hours when good events occur
    b. My mood brightens but I do not feel like my normal self when good events occur
    c. My mood brightens only somewhat to a rather limited range of desired events
    d. My mood does not brighten at all, even when very good or desired events occur in my life

9. Mood in Relation to the Time of Day:
    a. There is no regular relationship between my mood and the time of day
    b. My mood often relates to the time of day because of environmental events (e.g. being alone, working)
    c. In general, my mood is more related to the time of day than to environmental events
    d. My mood is clearly and predictably better or worse at a particular time each day

    9a. If you answered b, c, or d to question #9 – Is your mood typically worse in the:
        a. Morning
        b. Afternoon
        c. Night

9b. Is your mood variation attributed to the environment? ___YES___NO

10. The Quality of Your Mood:
    a. The mood (internal feelings) that I experience is very much a normal mood
    b. My mood is sad, but this sadness is pretty much like the sad mood I would feel if someone close to me died or left
    c. My mood is sad, but this sadness has a rather different quality to it than the sadness I would feel if someone close to me died or left
    d. My mood is sad, but this sadness is different from the type of sadness associated with grief or loss

PLEASE COMPLETE 11 OR 12 (NOT BOTH)

11. Decreased Appetite:
    a. There is no change in my usual appetite
    b. I eat somewhat less often or lesser amounts of food than usual
    c. I eat much less than usual and only with personal effort
    d. I rarely eat within a 24-hour period, and only with extreme personal effort or when others persuade me to eat

12. Increased Appetite:
    a. There is no change in my usual appetite
    b. I feel a need to eat more frequently than usual
    c. I regularly eat more often and/or greater amounts of food than usual
    d. I feel driven to overeat both at mealtime and between meals

PLEASE COMPLETE 13 OR 14 (NOT BOTH)

13. Within the Last Two Weeks:
    a. I have not had a change in my weight
    b. I feel as if I've had a slight weight loss
    c. I have lost 2 pounds or more
    d. I have lost 5 pounds or more

14. Within the Last Two Weeks:
    a. I have not changed my weight
    b. I feel as if I've had a slight weight gain
    c. I have gained 2 pounds or more
    d. I gained 5 pounds or more

15. Concentration/Decision Making:
    a. There is no change in my usual capacity to concentrate or make decisions
    b. I occasionally feel indecisive or find that my attention wanders
    c. Most of the time, I struggle to focus my attention or to make decisions
    d. I cannot concentrate well enough to read or cannot make even minor decisions

16. View of Myself:
    a. I see myself as equally worthwhile and deserving as other people
    b. I am more self-blaming than usual
    c. I largely believe that I cause problems for others
    d. I think almost constantly about major and minor defects in myself

17. View of My Future:
    a. I have an optimistic view of my future
    b. I am occasionally pessimistic about my future, but for the most part I believe things will get better
    c. I'm pretty certain that my immediate future (1-2 months) does not hold much promise of good things for me
    d. I see no hope of anything good happening to me anytime in the future

18. Thoughts of Death or Suicide:
    a. I do not think of suicide or death
    b. I feel that life is empty or wonder if it's worth living
    c. I think of suicide or death several times a week for several minutes
    d. I think of suicide or death several times a day in some detail, or I have made specific plans for suicide or have actually tried to take my life

19. General Interests:
    a. There is no change from usual in how interested I am in other people or activities
    b. I notice that I am less interested in people or activities
    c. I find I have interest in only one ore two of my formerly pursued activities
    d. I have virtually no interest in formerly pursued activities

20. Energy Level:
    a. There is no change in my usual level of energy
    b. I get tired more easily than usual
    c. I have to make a big effort to start or finish my usual daily activities (for example, shopping, home work, cooking, or going to work)
    d. I really cannot carry out most of my usual daily activities because I just don't have the energy

21. Capacity for Pleasure or Enjoyment (excluding sex):
    a. I enjoy pleasurable activities just as much as usual
    b. I do not feel my usual sense of enjoyment from pleasurable activities
    c. I rarely get a feeling of pleasure from any activity
    d. I am unable to get any pleasure or enjoyment from anything

22. Interest in Sex (Please rate interest, not activity):
    a. I'm just as interested in sex as usual
    b. My interest in sex is somewhat less than usual or I do not get the same pleasure from sex as I used to
    c. I have little desire for or rarely derive pleasure from sex
    d. I have absolutely no interest in or derive no pleasure from sex

23. Feeling Slowed Down:
    a. I think, speak, and move at my usual rate of speed
    b. I find that my thinking is slowed down or my voice sounds dull or flat
    c. It takes me several seconds to respond to most questions and I'm sure my thinking is slowed
    d. I am often unable to respond to questions without extreme effort

24. Feeling Restless:
    a. I do not feel restless
    b. I'm often fidgety, wring my hands, or need to shift how I am sitting
    c. I have impulses to move about and am quite restless
    d. At times, I am unable to stay seated and need to pace around

25. Aches and Pains:
    a. I don't have any feeling of heaviness in my arms of legs and don't have any aches or pains
    b. Sometimes I get headaches or pains in my stomach, back or joints but these pains are only sometimes present and they don't stop me from doing what I need to do
    c. I have these sorts of pains most of the time
    d. These pains are so bad they force me to stop what I am doing

26. Other Bodily Symptoms:
    a. I don't have any of these symptoms: heart pounding fast, blurred vision, sweating, hot and cold flashes, chest pain, heart turning over in my chest, ringing in my ears, or shaking
    b. I have some of these symptoms but they are mild and are present only sometime
    c. I have several of these symptoms and they bother my quite a bit
    d. I have several of these symptoms and when they occur I have to stop doing whatever I am doing

27. Panic/Phobic Symptoms:
    a. I have no spells of panic or specific fears (phobia) (such as animals or heights)
    b. I have mild panic episodes or fears that do not usually change my behavior or stop me from functioning
    c. I have significant panic episodes or fears that force me to change my behavior but do not stop me from functioning
    d. I have panic episodes at least once a week or severe fears that stop me from carrying on my daily activities

28. Constipation/Diarrhea:
    a. There is no change in my usual bowel habits
    b. I have intermittent constipation or diarrhea, which is mild
    c. I have diarrhea or constipation most of the time but it does not interfere with my day-to-day functioning
    d. I have constipation or diarrhea for which I take medicine or which interferes with my day-to-day activities

29. Interpersonal Sensitivity:
    a. I have not felt easily rejected, slighted, criticized, or hurt by others at all
    b. I have occasionally felt rejected, slighted, criticized, or hurt by others
    c. I have often felt rejected, slighted, criticized, or hurt by others, but these feelings have had only slight effects on my relationships at work
    d. I have often felt rejected, slighted, criticized, or hurt by others, and these feelings have impaired my relationships at work

30. Leaden Paralysis/Physical Energy:
    a. I have not experienced the physical sensation of feeling weighted down and without physical energy
    b. I have occasionally experienced periods of feeling physically weighted down and without physical energy, but without negative effect on work, school, or activity level
    c. I feel physically weighted down (without physical energy) more than half the time
    d. I feel physically weighted down (without physical energy) most of the time, several hours per day, several days per week

APPENDIX B

THE QUALITY OF LIFE AND ENJOYMENT SATISFACTION QUESTIONNAIRE (SHORT-FORM)

Subject ID_____

THE QUALITY OF LIFE ENJOYMENT AND SATISFACTION QUESTIONNAIRE

Directions: This questionnaire is designed to help assess the degree of enjoyment and satisfaction you have experienced during the past <u>week</u>. Please check the box that applies to each question.

GENERAL SATISFACTION

Taking everything into consideration during the past week how satisfied have you been with your….	**Very Poor**	**Poor**	**Fair**	**Good**	**Very Good**
…..physical health?					
…..mood?					
…..work?					
…..household activities?					
…..social relationships?					
…..family relationships?					
…..leisure time activities?					
…..ability to function in daily life?					
…..sexual drive, interest, and/or performance?*					
…..economic status?					
…..living/housing situation?*					
…..ability to get around physically without feeling dizzy or unsteady or falling?*					
…..your vision in terms of ability to do work or hobbies?*					
…..overall sense of well being?					
…..medication? (If not taking any, check this box and skip this question)					
How would you rate your OVERALL life satisfaction and contentment during the past week?					

**** If your satisfaction is VERY POOR, POOR, or FAIR on the starred item, please <u>underline</u> the factor(s) associated with your lack of satisfaction***

APPENDIX C

THE REVISED UCLA LONELINESS SCALE

Subject ID_____

THE REVISED LONELINESS SCALE (short form)

Directions: Indicate how often you feel the way described in each of the following statements. Circle one number for each.

Statement	Never	Rarely	Sometimes	Often
1. I feel in tune with the people around me*	1	2	3	4
2. I lack companionship	1	2	3	4
3. There is no one I can turn to	1	2	3	4
4. I do not feel alone*	1	2	3	4
5. I feel part of a group of friends*	1	2	3	4
6. I have a lot of common with the people around me*	1	2	3	4
7. I am no longer close to anyone	1	2	3	4
8. My interests and ideas are not shared by those around me	1	2	3	4
9. I am an outgoing person*	1	2	3	4
10. There are people I feel close to*	1	2	3	4
11. I feel left out	1	2	3	4
12. My social relationships are superficial	1	2	3	4
13. No one really knows me well	1	2	3	4
14. I feel isolated from others	1	2	3	4
15. I can find companionship when I want to*	1	2	3	4
16. There are people who really understand me*	1	2	3	4
17. I am unhappy being so withdrawn	1	2	3	4
18. People are around me but not with me	1	2	3	4
19. There are people I can talk to*	1	2	3	4
20. There are people I can turn to*	1	2	3	4

Note: The total score is the sum of all 20 items
**** Item should be reversed (i.e. 1 = 4, 2 = 3, 3 = 2, 4 = 1) before scoring***

APPENDIX D

RECRUITMENT LETTER AND FLYER

May 28, 2004

Dear Therapist:

Thank you for agreeing to distribute flyers for the "Lift Your Spirits" research study. The purpose of this study is to investigate the effects of a 12-week (2x/week) **relaxation exercise** or a **physical exercise** group in the treatment of clinical depression. Subjects with a diagnosis of clinical depression (dysthymia, major depressive disorder, bipolar) and who are taking antidepressant medication and/or seeing a therapist will be randomized to one of these two groups. Subjects must also be ambulatory and free of any type of disease, such as cancer, diabetes, cardiovascular disease, and severe asthma in order to participate.

Enclosed you will find 10 copies of the flyer. Please feel free to share this information with anyone you think may be interested. It is a great and much needed project, as previous research has indicated that relaxation skills and regular physical exercise can help decrease symptoms of depression. It is the hope that this study will support the development of such a program for all WPIC patients suffering from clinical depression.

I appreciate your help! Contact me with any further questions or concerns at klabt@pitt.edu or 412-648-3186.

Sincerely,

Kristie Abt, M.S.
Exercise Physiologist/Principal Investigator

LIFT YOUR SPIRITS!

Do you have concerns about how you feel? Would you like to feel happier, confident, and more energetic?

Researchers at the University of Pittsburgh are seeking participants for an experimental treatment program for depression. This study will investigate the effects of a 12-week *relaxation exercise* or *physical exercise* intervention in the treatment of depression. Men and women between the ages of 25-60 years who have been diagnosed with depression and are currently involved in standard treatment (antidepressant medication and therapy) may be eligible.

Assessments, interventions, and travel expenses are provided at no cost.

Interested volunteers should contact Kristie Abt at 412-648-3186 or klabt@pitt.edu for further information.

APPENDIX E

THE PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check **YES** or **NO**.

YES	NO	
____	____	**1. Has your doctor every said that you have a heart condition and that you should only do physical activity that is recommended by a doctor?**
____	____	**2. Do you feel pain in your chest when you do physical activity?**
____	____	**3. In the past month, have you had chest pain when you were not doing physical activity?**
____	____	**4. Do you loose your balance because of dizziness or do you ever lose consciousness?**
____	____	**5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?**
____	____	**6. Is your doctor currently prescribing drugs (for example water pills) for your blood pressure or heart condition?**
____	____	**7. Do you know of any other reason why you should not do physical activity?**

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

Name_____

Signature_____ **Date**_____

APPENDIX F

PRIMARY CARE PHYSICIAN REFERRAL LETTER

Dear Primary Care Physician:

Your patient, Mr. X, has been recruited to participate in a research study at the University of Pittsburgh investigating the effects of an exercise program in the treatment of depression. The exercise program will consist of moderate-intensity cardiovascular, strength, and flexibility training. Please see attached form for further details of the exercise program.

During the eligibility screening procedure, your patient reported the following conditions:

1. Hypertension (on antihypertensive medications)
2. Hypercholesterolemia

In order to ensure the safety of your patient, a medical clearance is required prior to participation. Please complete the attached form and return it in the provided self-addressed stamped envelope. The request of this information has obtained University of Pittsburgh Institutional Review Board (IRB) approval and all subject information will be kept confidential.

Thank you for your assistance in this matter. Please feel free to contact me at 412-648-3186 or klabt@pitt.edu should you have further questions or concerns.

Sincerely,

Kristie L. Abt, M.S.
Principal Investigator
Exercise Physiologist

LIFT YOUR SPIRITS EXERCISE PROGRAM

Subjects in the exercise group will attend two, 1-hour group sessions per week, with at least 48 hours in between each session, for a total of 6-weeks. Exercise sessions will be held at the University of Pittsburgh. The principle investigator, assisted by one experienced exercise physiologists, will lead all exercise sessions.

Each session will begin with a 10 minute warm-up consisting of light aerobic activity and static stretching. The aerobic segment of the warm-up will include low-impact, low-intensity traditional floor aerobic moves. Static stretching exercises will be performed targeting all major joints of the body (hip, back, shoulder, knee, upper trunk, and neck). Stretches will be performed slowly and held for 30 seconds. Subjects will be instructed on proper stretching form.

A 35-minute interval training program will alternate two minutes of resistance exercises and three minutes of aerobic activity. During the resistance interval, resistance exercises performed will target all major muscle groups. Each resistance interval will consist of two resistance exercises performed for one minute each. Subjects will have the option to use hand weights. The primary investigator will assist each subject in selecting the appropriate hand weights (three sets of dumbbells – light, medium, and heavy pair). Aerobic intervals will consist of various traditional low-impact floor aerobic exercises. Instructors will assist subjects in correct techniques and will encourage subjects to work within their "comfort zone" during the course of each class. A 15 minute cool-down, consisting of light aerobic activity and static stretching exercises will follow each training session.

PHYSICIAN'S CLEARANCE FORM

Mr. X has been examined by me and has my approval to participate in an exercise program consisting of cardiovascular, strength, and flexibility training. I understand the physical and physiological stressors of the program and see no reason why the above named person should not participate.

_____ M.D. _____
Physician's Signature Date

PHYSICIAN'S RECOMMENDATIONS/CONTRAINDICATIONS
Please indicate if you have any recommendations for the participant and/or primary investigator and whether or not any contraindications exist.

_____
_____
_____
_____
_____
_____
_____
_____

Please return this form to:

Kristie Abt, M.S. (principal investigator)
University of Pittsburgh
140 Trees Hall
Pittsburgh, PA 15261
Fax: 412-648-7092

APPENDIX G

MEDICAL HISTORY

MEDICAL HISTORY QUESTIONNAIRE

Demographic Information

Last Name	First Name	Middle Initial
Age	Gender	Home Phone
Address	City, State	Zip Code
Work Phone	E-Mail Address	
Emergency Contact	Phone Number	
Primary Therapist	Phone Number	E-Mail Address
Primary Care Physician	Phone Number	E-Mail Address

Marital status:
___Married ___Single ___Widowed ___Divorced ___Separated

Ethnicity:
___White, Caucasian ___Black, African American ___Native American
___Asian ___Hispanic ___Other – Specify_____

Highest Obtained Education Level:
___Grade school ___High school/GED ___Vocational training (after high school)
___Some college/Associate degree ___College graduate ___Master's Degree
___Doctoral degree

Occupation:
___Working full time for pay – number of hours per week_____
___Working part time for pay – number of hours per week_____
___Not currently employed, looking for work
___Retired
___Homemaker
___Disables
___Other – specify_____

Annual Income (before taxes):

___Less than $5,000
___$5,000 - $9,999
___$10,000 - $14,999
___$15,000 - $19,999
___$20,000 - $29,999
___$30,000 - $39,999
___$40,000 – $49,999
___$50,000 - $59,999
___$60,000 – $74,999
___$75,000 - $99,000
___$100,000 - $124,000
___$125,000 - $149,000
___$150,000 or more

Mental Health Questions:

When were you diagnosed with depression? _____

List all medications you are currently taking (include dosage): _____
_____

How many times per week do your meet with your therapist? _____

Risk Factors:

1. Have any of your parents, brothers, sisters had a heart attack, bypass surgery angioplasty, or sudden death prior to the age of 55 (male relatives) or 65 (female relatives)? YES NO

2. Have you smoked cigarettes in the past 6 months? YES NO

3. What is your usual blood pressure (≥140/90)? _____
   Do you take blood pressure medication? YES NO

4. What is your LDL cholesterol? If you don't know your LDL, what is your total cholesterol? What is your HDL cholesterol?
   (Either LDL >130 (use total cholesterol >200 if LDL is not known) OR HDL <40)

   LDL_____ TC_____ HDL_____

5. What is your fasting glucose (≥110)? _____

6. What is your height and weight (BMI >30)?

   Height_____ Weight_____ BMI_____

7. Do you get at least 30 minutes of moderate physical activity most days of the week? YES NO

Signs and Symptoms:

1. Do you have pain or discomfort in your chest or surrounding areas? YES NO

2. Do you ever feel faint or dizzy (other than sitting up rapidly)? YES NO

3. Do you find it difficult to breathe when you are lying down or sleeping? YES NO

4. Do your ankles ever become swollen (other than after long periods of standing or sitting)? YES NO

5. Do you ever have heart palpitations, or an unusual period of rapid heart rate? YES NO

6. Has a physician ever said you had a heart murmur? (Has he/she said it is OK, and safe for you to exercise?) YES NO

7. Do you feel unusually fatigued or find it difficult to breathe with usual activities? YES NO

8. Do you ever experience cramp-like pain in your calves? YES NO

Other:

1. When was the last time you had a physical examination? _____

2. Do you have any of the following diseases: heart disease, peripheral vascular disease, cerebrovascular disease, chronic obstructive pulmonary disease (emphysema or chronic bronchitis), asthma, interstitial lung disease, cystic fibrosis, diabetes mellitus, thyroid disorders, renal disease, or liver disease? YES NO

   If you answered "yes" to the above question list the condition(s)_____
   _____

3. Do you have any bone or joint problems, such as arthritis or a past injury that might get worse with exercise? YES NO

   If you answered "yes" to the above question list the condition(s)_____
   _____

4. Have you ever been hospitalized or undergone surgery? YES NO

   If you answered "yes" to the above question describe conditions_____
   _____

5. Are you pregnant or lactating? YES NO

6. Do you have any other problem that might make it difficult for you to exercise? YES NO

   If you answered "yes" to the above question list the condition(s)_____
   _____

****

To be completed by the interviewer:

Interpretation:

_____ Low Risk: young and no more than one risk factor
_____ Moderate Risk: older, or 2 or more risk factors
_____ High Risk: known disease or at least one major sign or symptom

APPENDIX H

PRIMARY THERAPIST VERIFICATION LETTER

Dear Primary Therapist:

Your patient, Mr. X, has been recruited to participate in a research study at the University of Pittsburgh examining the effects of complimentary treatment modalities in depression. Your patient will be randomized and will participate in either a 12-week exercise group or a stress coping/relaxation group.

In order to be eligible for participation, your patient must have written verification of depression diagnosis, duration of illness, and nature and intensity of concurrent treatment. Please review the attached form to verify that this information is correct and return this letter in the provided self-addressed stamped envelope. The request of this information has obtained Institutional Review Board (IRB) approval and all subject information will be kept confidential.

Thank you for your assistance in this matter. Please feel free to contact me at 412-648-3186 or klabt@pitt.edu should you have further questions or concerns.

Sincerely,

Kristie L. Abt, M.S.
Exercise Physiologist
Principal Investigator

PRIMARY THERAPIST VERIFICATION FORM

Mr. X has been diagnosed with major depressive disorder according to the DSM-IV, since _____. This patient's current treatment program consists of therapy (approximately once every week) and the following medication(s):

1. Serzone 600 mg/day

Please confirm that the above information is correct, to the best of your knowledge, by signing this form.

_____ _____

Therapist's Signature Date

APPENDIX I

GROUP EXERCISE INTERVENTION PROTOCOL

EXERCISE SESSION RECORDING FORM

Name_____ **Date**_____

EXERCISE SESSION

INTERVAL	EXERCISE	SETS	REPS	WEIGHT	RPE
1	Squat	1			
	Bicep Curl	1			
CARDIO 1					
2	Lunges or Leg Extension with Thera-Band	1			
	Shoulder Press	1			
CARDIO 2					
3	Calf Raises	1			
	Tricep Overhead Extensions	1			
CARDIO 3					
4	Hamstring Curls with Thera-Bands	1			
	Row with Tubing	1			
CARDIO 4					
4	Standing Leg Abduction with Thera-Bands	1			
	Push-ups or Chest Press with Tubing	1			
CARDIO 5					
6	Shoulder Front Raise	1			
	Shoulder Side Raise	1			
Cool-Down	Abdominal Crunches	1			

Oblique Crunches	**1**
“Supermans”	**1**
Trunk Extensions	**1**

Overall, how do you feel?_____

Compared to last week, is this getting easier or harder?_____
Additional Comments?_____

APPENDIX J

STRESS COPING PROTOCOL

STRESS COPING PROTOCOL

WEEK	SESSION 1 TOPIC	SESSION 2 TOPIC
1	Introduction to Class	Acute versus Chronic Stress
	Exercise: Diaphragmatic Breathing	***Exercise:*** Diaphragmatic Breathing
2	Fight of Flight/Problem Solving	Stress and the Immune System
	Exercise: Body Awareness	***Exercise:*** Awareness
3	Meditation	Meditation
	Exercise: Meditation	***Exercise:*** Meditation/Body Awareness
4	Meditation/Guided Imagery	Biofeedback
	Exercise: Guided Imagery	***Exercise:*** Guided Imagery
5	Meditation	Progressive Muscle Relaxation
	Exercise: Meditation	***Exercise:*** PMR
6	Defining "Age"	Review
	Exercise: PMR	
7	Muscle Relaxation	Worry
	Exercise: Muscle Relaxation	
8	Worry	Assertiveness
9	Assertiveness	Writing to Relieve Stress
		Exercise: Writing Exercise
10	Physical Fitness for Mental and Physical Health	Physical Fitness for Mental and Physical Health
		Exercise: Therabands and Stretching
11	Nutrition – Guest Speaker	Flexibility and Stretching
12	Review	Benefits of Stress Coping
		Exercise: Individual Choice

APPENDIX K

INSTRUCTOR EVAULATION

UNIVERSITY OF PITTSBURGH
"LIFT YOUR SPIRITS" INSTRUCTOR RATING FORM

Directions: Please respond to each of the questions listed below. Your responses will be used to further enhance the "Lift Your Spirits" Program. Please be sure to answer all questions as honestly as possible. When you have completed this form, return it in the provided addressed and stamped envelope. Your responses will be confidential.

Group: Stress Coping
Instructor: Kristie Abt

	Excellent	Above Average	Average	Below Average	Poor
1. Clearly relates learning goals, outcomes, and objectives.	**5**	**4**	**3**	**2**	**1**
2. Appraises individual differences of participants and makes provision for needs in instruction.	**5**	**4**	**3**	**2**	**1**
3. Evokes pupil interest in learning.	**5**	**4**	**3**	**2**	**1**
4. Is enthusiastic about class.	**5**	**4**	**3**	**2**	**1**
5. Relates to participants on a friendly and personal level, yet remains professional.	**5**	**4**	**3**	**2**	**1**
6. Knowledge of subject matter.	**5**	**4**	**3**	**2**	**1**
7. Instructor speaks clearly.	**5**	**4**	**3**	**2**	**1**
8. Instructor provided information regarding the correctness or incorrectness of skill attempts.	**5**	**4**	**3**	**2**	**1**

9. Additional comments about instructor:

10. What did you like most about this class?

11. What did you like least about this class?

APPENDIX L

INTENT-TO-TREAT CONFOUNDER DATA

Table 29: Confounder Analysis- Gender (Mean Scores and Standard Deviations)

IDS-SR	**Pretest**		**Posttest**	
	Females	**Males**	**Females**	**Males**
Exercise	28.45 (16.1)	29.5 (16.68)	28.09 (18.61)	25.5 (11.83)
Social Control	32.0 (12.3)	27.0 (8.37)	29.2 (10.49)	18.0 (2.94)

Q-LES-Q	**Pretest**		**Posttest**	
	Females	**Males**	**Females**	**Males**
Exercise	44.36 (13.43)	40.83 (5.6)	45.45 (13.15)	44.5 (6.72)
Social Control	41.8 (8.0)	44.0 (10.8)	41.8 (8.82)	53.75 (2.63)

UCLA Loneliness	**Pretest**		**Posttest**	
	Females	**Males**	**Females**	**Males**
Exercise	45.0 (13.6)	45.83 (9.62)	45.0 (15.43)	45.33 (9.56)
Social Control	45.8 (11.22)	42.5 (11.21)	41.9 (12.57)	39.0 (4.55)

Table 30: Confounder Analysis- Ethnicity (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
Caucasian	24.0 (13.9)	21.42 (11.22)
African American	34.67 (12.66)	35.67 (24.54)
Native American	45.0 (0.0)	45.0 (0.0)
Asian	53.0 (0.0)	53.0 (0.0)
Social Control		
Caucasian	29.45 (9.7)	24.55 (9.8)
African American	41.5 (19.09)	36.5 (12.02)
Native American	21.0 (0.0)	21.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	Pretest	Posttest
Exercise		
Caucasian	46.92 (10.04)	48.42 (8.71)
African American	38.0 (5.57)	43.33 (11.59)
Native American	36.0 (0.0)	36.0 (0.0)
Asian	20.0 (0.0)	20.0 (0.0)
Social Control		
Caucasian	41.91 (7.6)	45.27 (9.13)
African American	38.5 (12.02)	39.5 (10.61)
Native American	56.0 (0.0)	56.0 (0.0)
Asian	20.0 (0.0)	0.0 (0.0)

UCLA Loneliness	Pretest	Posttest

Exercise		
Caucasian	43.08 (11.98)	40.42 (12.52)
African American	43.0 (1.73)	52.67 (2.52)
Native American	55.0 (0.0)	55.0 (0.0)
Asian	69.0 (0.0)	69.0 (0.0)
Social Control		
Caucasian	46.18 (9.52)	40.64 (7.98)
African American	40.5 (23.34)	44.5 (28.99)
Native American	39.0 (0.0)	39.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)

Table 31: Confounder Analysis- Education (Mean Scores and Standard Deviations)

IDS-SR	**Pretest**	**Posttest**
Exercise		
High School/GED	34.67 (21.46)	44.67 (19.5)
Vocational Training (after HS)	18.5 (9.19)	17.0 (7.07)
Some College/Associates Degree	35.38 (13.73)	28.75 (15.05)
College Graduate	17.0 (8.49)	17.0 (8.49)
Masters Degree	18.8 (0.0)	21.0 (0.0)
Doctoral Degree	14.0 (0.0)	9.0 (0.0)
Social Control		
High School/GED	22.33 (2.08)	25.33 (6.81)
Vocational Training (after HS)	0.0 (0.0)	0.0 (0.0)
Some College/Associates	26.0 (0.0)	12.0 (0.0)

Degree		
College Graduate	38.33 (12.01)	31.67 (10.78)
Masters Degree	28.0 (10.54)	21.67 (10.69)
Doctoral Degree	21.0 (0.0)	21.0 (0.0)

Q-LES-Q	**Pretest**	**Posttest**
Exercise		
High School/GED	42.0 (13.08)	38.0 (8.19)
Vocational Training (after HS)	52.0 (11.31)	52.5 (10.61)
Some College/Associates Degree	39.13 (12.61)	43.63 (13.51)
College Graduate	48.0 (2.83)	52.0 (2.83)
Masters Degree	42.0 (0.0)	42.0 (0.0)
Doctoral Degree	52.0 (0.0)	52.0 (0.0)
Social Control		
High School/GED	44.0 (8.72)	38.67 (10.79)
Vocational Training (after HS)	0.0 (0.0)	0.0 (0.0)
Some College/Associates Degree	47.0 (0.0)	54.0 (0.0)
College Graduate	39.83 (9.91)	43.67 (9.4)
Masters Degree	40.0 (3.61)	48.33 (6.66)
Doctoral Degree	56.0 (0.0)	56.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		

High School/GED	42.67 (11.59)	50.33 (8.08)
Vocational Training (after HS)	38.0 (8.49)	42.5 (14.85)
Some College/Associates Degree	49.25 (14.28)	48.0 (16.66)
College Graduate	39.5 (14.28)	32.5 (4.95)
Masters Degree	48.0 (0.0)	43.0 (0.0)
Doctoral Degree	45.0 (0.0)	39.0 (0.0)
Social Control		
High School/GED	39.33 (4.16)	39.33 (4.16)
Vocational Training (after HS)	0.0 (0.0)	0.0 (0.0)
Some College/Associates Degree	49.0 (0.0)	34.0 (0.0)
College Graduate	46.67 (14.54)	44 (15.93)
Masters Degree	47.33 (11.59)	40.0 (6.56)
Doctoral Degree	39.0 (0.0)	39 (0.0)

Table 32: Confounder Analysis- Occupation (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
Working full-time	25.67 (16.67)	20.67 (14.12)
Working part-time	14.5 (4.95)	16.0 (7.07)
Not-employed; looking for work	40.5 (6.36)	31.0 (19.8)
Retired	10.0 (0.0)	25.0 (0.0)
Homemaker	37.0 (0.0)	37.0 (0.0)
Disabled	41.33 (16.86)	46.33 (21.78)
Other	27.5 (3.54)	21.5 (0.71)
Social Control		
Working full-time	23.5 (5.69)	19.75 (7.76)
Working part-time	31.0 (9.9)	33.5 (0.71)
Not-employed; looking for work	31.67 (5.51)	19.67 (7.23)
Retired	20.0 (0.0)	20.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	39.25 (16.09)	34.75 (10.91)
Other	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	Pretest	Posttest
Exercise		
Working full-time	46.5 (10.73)	49.17 (10.28)
Working part-time	46.0 (5.66)	46.5 (4.95)
Not-employed; looking for work	36.0 (0.0)	41.5 (7.78)
Retired	57.0 (0.0)	47.0 (0.0)

Homemaker	38.0 (0.0)	38.0 (0.0)
Disabled	38.0 (20.95)	37.33 (21.22)
Other	40.5 (4.95)	49.5 (6.36)
Social Control		
Working full-time	50.5 (5.92)	52.5 (5.07)
Working part-time	43.5 (6.36)	37.5 (9.19)
Not-employed; looking for work	37.33 (4.51)	50.0 (7.21)
Retired	50.0 (0.0)	51.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	35.75 (7.68)	36.75 (6.9)
Other	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
Working full-time	45.17 (12.95)	40.67 (14.96)
Working part-time	38.5 (13.44)	36.0 (9.9)
Not-employed; looking for work	49.0 (8.49)	44.5 (14.85)
Retired	32.0 (0.0)	41.0 (0.0)
Homemaker	60.0 (0.0)	60.0 (0.0)
Disabled	48.0 (18.52)	52.67 (17.62)
Other	44.0 (0.0)	51.5 (2.12)
Social Control		
Working full-time	50.75 (9.03)	43.0 (11.58)
Working part-time	44.5 (12.02)	41.5 (7.78)
Not-employed; looking for work	43.33 (13.65)	38.67 (5.69)
Retired	38.0 (0.0)	38.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)

Disabled	42.0 (13.59)	41.5 (17.67)
Other	0.0 (0.0)	0.0 (0.0)

Table 33: Confounder Analysis- Severity (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
Score of 15-20	11.8 (1.48)	12.6 (7.3)
Score of 21-25	24.33 (6.03)	21.33 (0.58)
Score of 26-30	23.0 (0.0)	23.0 (0.0)
Score of 31-35	22.0 (0.0)	22.0 (0.0)
Score of 36-40	37.0 (0.0)	37.0 (0.0)
Score of 41-45	45.4 (6.19)	37.8 (13.68)
Score of 46-50	0.0 (0.0)	0.0 (0.0)
Score of 51-55	0.0 (0.0)	0.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	33.0 (0.0)	31.0 (0.0)
Social Control		
Score of 15-20	24.0 (5.66)	24.0 (5.66)
Score of 21-25	24.0 (0.0)	33.0 (0.0)
Score of 26-30	26.33 (3.51)	21.67 (9.07)
Score of 31-35	23.75 (5.74)	20.0 (5.94)
Score of 36-40	38.0 (0.0)	16.0 (0.0)
Score of 41-45	38.0 (0.0)	34.0 (0.0)
Score of 46-50	55.0 (0.0)	45.0 (0.0)
Score of 51-55	51.0 (0.0)	43.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	Pretest	Posttest
Exercise		
Score of 15-20	54.4 (4.04)	53.0 (5.1)

Score of 21-25	41.0 (3.61)	47.33 (5.86)
Score of 26-30	46.0 (0.0)	54.0 (0.0)
Score of 31-35	61.0 (0.0)	61.0 (0.0)
Score of 36-40	38.0 (0.0)	38.0 (0.0)
Score of 41-45	32.0 (6.93)	35.2 (9.83)
Score of 46-50	0.0 (0.0)	0.0 (0.0)
Score of 51-55	0.0 (0.0)	0.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	33.0 (0.0)	31.0 (0.0)
Social Control		
Score of 15-20	46.0 (5.66)	46.5 (6.36)
Score of 21-25	48.0 (0.0)	31.0 (0.0)
Score of 26-30	45.33 (10.6)	47.67 (0.0)
Score of 31-35	46.0 (7.88)	51.0 (5.83)
Score of 36-40	33.0 (0.0)	52.0 (0.0)
Score of 41-45	39.0 (0.0)	44.0 (0.0)
Score of 46-50	30.0 (0.0)	32.0 (0.0)
Score of 51-55	32.0 (0.0)	34.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
Score of 15-20	33.2 (6.83)	33.4 (6.43)
Score of 21-25	45.33 (2.31)	48.67 (5.13)
Score of 26-30	50.0 (0.0)	36.0 (0.0)
Score of 31-35	34.0 (0.0)	34.0 (0.0)
Score of 36-40	60.0 (0.0)	60.0 (0.0)
Score of 41-45	56.6 (9.53)	53.8 (15.77)

Score of 46-50	0.0 (0.0)	0.0 (0.0)
Score of 51-55	0.0 (0.0)	0.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	41.0 (0.0)	55.0 (0.)
Social Control		
Score of 15-20	37.5 (0.71)	37.5 (0.71)
Score of 21-25	36.0 (0.0)	36.0 (0.0)
Score of 26-30	51.0 (8.19)	46.0 (13.12)
Score of 31-35	38.0 (12.94)	34.0 (7.07)
Score of 36-40	59.0 (0.0)	45.0 (0.0)
Score of 41-45	53.0 (0.0)	47.0 (0.0)
Score of 46-50	57.0 (0.0)	65.0 (0.0)
Score of 51-55	43.0 (0.0)	33.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	0.0 (0.0)	0.0 (0.0)

APPENDIX M

NON-INTENT-TO-TREAT CONFOUNDER DATA

Table 34: Confounder Analysis- Gender (Mean Scores and Standard Deviations)

IDS-SR	**Pretest**		**Posttest**	
	Females	**Males**	**Females**	**Males**
Exercise	24.78 (14.97)	30.25 (12.82)	24.33 (18.15)	24.25 (5.85)
Social Control	35.17 (15.43)	33.5 (6.36)	30.5 (13.69)	15.5 (0.71)

Q-LES-Q	**Pretest**		**Posttest**	
	Females	**Males**	**Females**	**Males**
Exercise	47.78 (11.53)	39.75 (3.86)	49.11 (10.64)	45.25 (6.34)
Social Control	40.0 (7.67)	35.9 (2.83)	40.0 (9.14)	54.0 (2.83)

UCLA Loneliness	**Pretest**		**Posttest**	
	Females	**Males**	**Females**	**Males**
Exercise	40.67 (10.5)	47.75 (5.19)	40.67 (13.29)	47.0 (5.35)
Social Control	48.84 (8.01)	46.5 (17.68)	42.33 (12.19)	39.5 (7.78)

Table 35: Confounder Analysis- Ethnicity (Mean Scores and Standard Deviations)

IDS-SR	**Pretest**	**Posttest**
Exercise		
Caucasian	24.0 (14.09)	20.9 (10.7)
African American	34.67 (12.66)	35.67 (24.540
Native American	0.0 (0.0)	0.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)
Social Control		
Caucasian	31.86 (11.31)	24.14 (12.21)
African American	55.0 (0.0)	55.0 (0.0)
Native American	0.0 (0.0)	0.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	**Pretest**	**Posttest**
Exercise		
Caucasian	47.5 (10.63)	49.3 (8.92)
African American	38.0 (5.57)	43.3 (11.59)
Native American	0.0 (0.0)	0.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)
Social Control		
Caucasian	40.0 (6.48)	45.14 (9.74)
African American	30.0 (0.0)	32.0 (0.0)
Native American	0.0 (0.0)	0.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**

Exercise		
Caucasian	42.8 (11.02)	39.6 (11.56)
African American	43.0 (1.73)	52.67 (2.52)
Native American	0.0 (0.0)	0.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)
Social Control		
Caucasian	47.0 (9.61)	38.29 (5.65)
African American	57.0 (0.0)	65.0 (0.0)
Native American	0.0 (0.0)	0.0 (0.0)
Asian	0.0 (0.0)	0.0 (0.0)

Table 36: Confounder Analysis- Education (Mean Scores and Standard Deviations)

IDS-SR	**Pretest**	**Posttest**
Exercise		
High School/GED	29.5 (27.58)	44.5 (27.58))
Vocational Training (after HS)	18.5 (9.19)	17 (7.07)
Some College/Associates Degree	32.17 (13.75)	23.33 (12.28)
College Graduate	23.0 (0.0)	23 (0.0)
Masters Degree	18 (0.0)	21 (0.0)
Doctoral Degree	14 (0.0)	9 (0.0)
Social Control		
High School/GED	24.0 (0.0)	33.0 (0.0)
Vocational Training (after HS)	0.0 (0.0)	0.0 (0.0)
Some College/Associates Degree	26 (0.0)	12 (0.0)

College Graduate	48.0 (8.89)	34.67 (16.2)
Masters Degree	28.0 (10.54)	21.67 (10.69)
Doctoral Degree	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	**Pretest**	**Posttest**
Exercise		
High School/GED	45 (16.97)	39 (11.31)
Vocational Training (after HS)	52.0 (11.31)	52.5 (10.61)
Some College/Associates Degree	42.5 (11.64)	48.5 (10.45)
College Graduate	46.0 (0.0)	54.0 (0.0)
Masters Degree	42.0 (0.0)	43.0 (0.0)
Doctoral Degree	52.0 (0.0)	52.0 (0.0)
Social Control		
High School/GED	48.0 (0.0)	31.0 (0.0)
Vocational Training (after HS)	0.0 (0.0)	0.0 (0.0)
Some College/Associates Degree	47.0 (0.0)	54.0 (0.0)
College Graduate	31.67 (1.53)	39.33 (11.02)
Masters Degree	40.0 (3.61)	48.33 (8.66)
Doctoral Degree	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
High School/GED	46.8 (6.34)	48.0 (9.9)

Vocational Training (after HS)	38.0 (8.49)	42.5 (14.85)
Some College/Associates Degree	44.17 (12.38)	42.5 (15.33)
College Graduate	50.0 (0.0)	36.0 (0.0)
Masters Degree	48.0 (0.0)	43.0 (0.0)
Doctoral Degree	45.0 (0.0)	39 (0.0)
Social Control		
High School/GED	36.0 (0.0)	36.0 (0.0)
Vocational Training (after HS)	0.0 (0.0)	0.0 (0.0)
Some College/Associates Degree	49.0 (0.0)	34 (0.0)
College Graduate	53.0 (8.72)	47.67 (16.17)
Masters Degree	47.33 (11.55)	40.0 (6.56)
Doctoral Degree	0.0 (0.0)	0.0 (0.0)

Table 37: Confounder Analysis- Occupation (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
Working full-time	25.67 (16.67)	20.67 (14.12)
Working part-time	18.0 (0.0)	21.0 (0.0)
Not-employed; looking for work	36.0 (0.0)	17.0 (0.0)
Retired	10.0 (0.0)	25.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	35.5 (19.09)	43.0 (29.7)
Other	27.5 (3.54)	21.5 (0.71)
Social Control		
Working full-time	21.5 (6.36)	14.0 (2.83)
Working part-time	31.0 (9.9)	33.5 (0.71)
Not-employed; looking for work	33.5 (6.36)	15.5 (0.71)
Retired	0.0 (0.0)	0.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	53.0 (2.83)	44.0 (1.41)
Other	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	Pretest	Posttest
Exercise		
Working full-time	46.5 (10.73)	49.17 (10.28)
Working part-time	42.0 (0.0)	43.0 (0.0)
Not-employed; looking for work	36.0 (0.0)	47.0 (0.0)
Retired	57.0 (0.0)	47.0 (0.0)

Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	47.0 (19.8)	46.0 (21.21)
Other	40.5 (4.95)	49.5 (6.36)
Social Control		
Working full-time	45.5 (2.12)	49.5 (6.36)
Working part-time	43.5 (6.63)	37.5 (9.19)
Not-employed; looking for work	35.0 (2.83)	54.0 (2.83)
Retired	0.0 (0.0)	0.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	31.0 (1.41)	33.0 (1.41)
Other	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
Working full-time	45.17 (12.95)	40.67 (14.96)
Working part-time	48.0 (0.0)	43.0 (0.0)
Not-employed; looking for work	43.0 (0.0)	34.0 (0.0)
Retired	32.0 (0.0)	41.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)
Disabled	37.5 (4.95)	44.5 (14.85)
Other	44.0 (0.0)	51.5 (2.12)
Social Control		
Working full-time	52.0 (4.24)	36.5 (3.54)
Working part-time	44.5 (12.02)	41.5 (7.78)
Not-employed; looking for work	46.5 (12.68)	39.5 (7.78)
Retired	0.0 (0.0)	0.0 (0.0)
Homemaker	0.0 (0.0)	0.0 (0.0)

Disabled	50.0 (9.9)	49.0 (22.63)
Other	0.0 (0.0)	0.0 (0.0)

Table 38: Confounder Analysis- Annual Income (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
Refused to Disclose Information	16.5 (9.19)	24.0 (1.41)
Less than $5,000	30.0 (0.0)	21.0 (0.0)
$5,000-9,999	49.0 (0.0)	64.0 (0.0)
$10,000-14,999	0.0 (0.0)	0.0 (0.0)
$15,000-19,999	0.0 (0.0)	0.0 (0.0)
$20,000-29,999	21.75 (15.76)	20.0 (15.3)
$30,000-39,999	0.0 (0.0)	0.0 (0.0)
$40,000-49,000	25.0 (0.0)	22.0 (0.0)
$50,000-59,999	28.0 (17.73)	21.33 (12.01)
$60,000-74,000	0.0 (0.0)	0.0 (0.0)
Greater than $100,000	36.0 (0.0)	17.0 (0.0)
Social Control		
Refused to Disclose Information	55.0 (0.0)	45.0 (0.0)
Less than $5,000	0.0 (0.0)	0.0 (0.0)
$5,000-9,999	37.75 (11.03)	31.5 (11.27)
$10,000-14,999	0.0 (0.0)	0.0 (0.0)
$15,000-19,999	17.0 (0.0)	16.0 (0.0)
$20,000-29,999	26.0 (0.0)	12.0 (0.0)
$30,000-39,999	29.0 (0.0)	15.0 (0.0)
$40,000-49,000	0.0 (0.0)	0.0 (0.0)
$50,000-59,999	0.0 (0.0)	0.0 (0.0)
$60,000-74,000	0.0 (0.0)	0.0 (0.0)

Greater than $100,000	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	**Pretest**	**Posttest**
Exercise		
Refused to Disclose Information	51.50 (7.78)	50.5 (4.95)
Less than $5,000	37.0 (0.0)	54.0 (0.0)
$5,000-9,999	33.0 (0.0)	31.0 (0.0)
$10,000-14,999	0.0 (0.0)	0.0 (0.0)
$15,000-19,999	0.0 (0.0)	0.0 (0.0)
$20,000-29,999	46.75 (12.31)	48.25 (11.96)
$30,000-39,999	0.0 (0.0)	0.0 (0.0)
$40,000-49,000	44.0 (0.0)	45.0 (0.0)
$50,000-59,999	49.67 (12.66)	50.67 (11.06)
$60,000-74,000	0.0 (0.0)	0.0 (0.0)
Greater than $100,000	36.0 (0.0)	47.0 (0.0)
Social Control		
Refused to Disclose Information	30.0 (0.0)	32.0 (0.0)
Less than $5,000	0.0 (0.0)	0.0 (0.0)
$5,000-9,999	38.0 (7.35)	40.25 (9.61)
$10,000-14,999	0.0 (0.0)	0.0 (0.0)
$15,000-19,999	44.0 (0.0)	45.0 (0.0)
$20,000-29,999	47.0 (0.0)	54.0 (0.0)
$30,000-39,999	37.0 (0.0)	56.0 (0.0)
$40,000-49,000	0.0 (0.0)	0.0 (0.0)
$50,000-59,999	0.0 (0.0)	0.0 (0.0)

$60,000-74,000	0.0 (0.0)	0.0 (0.0)
Greater than $100,000	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
Refused to Disclose Information	41.0 (12.73)	38.5 (3.54)
Less than $5,000	44.0 (0.0)	50.0 (0.0)
$5,000-9,999	41.0 (0.0)	55.0 (0.0)
$10,000-14,999	0.0 (0.0)	0.0 (0.0)
$15,000-19,999	0.0 (0.0)	0.0 (0.0)
$20,000-29,999	42.25 (15.2)	42.5 (19.02)
$30,000-39,999	0.0 (0.0)	0.0 (0.0)
$40,000-49,000	44.0 (0.0)	53.0 (0.0)
$50,000-59,999	44.67 (10.5)	38.33 (4.04)
$60,000-74,000	0.0 (0.0)	0.0 (0.0)
Greater than $100,000	43.0 (0.0)	34.0 (0.0)
Social Control		
Refused to Disclose Information	57.0 (0.0)	65.0 (0.0)
Less than $5,000	0.0 (0.0)	0.0 (0.0)
$5,000-9,999	47.75 (10.24)	40.25 (6.8)
$10,000-14,999	0.0 (0.0)	0.0 (0.0)
$15,000-19,999	55.0 (0.0)	35.0 (0.0)
$20,000-29,999	49.0 (0.0)	34.0 (0.0)
$30,000-39,999	34.0 (0.0)	34.0 (0.0)
$40,000-49,000	0.0 (0.0)	0.0 (0.0)

$50,000-59,999	0.0 (0.0)	0.0 (0.0)
$60,000-74,000	0.0 (0.0)	0.0 (0.0)
Greater than $100,000	0.0 (0.0)	0.0 (0.0)

Table 39: Confounder Analysis- Duration of Illness (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
1-5 years	28.55 (14.29)	25.73 (15.98)
6-10 years	18.0 (0.0)	21.0 (0.0)
14-15 years	0.0 (0.0)	0.0 (0.0)
16-20 years	0.0 (0.0)	0.0 (0.0)
21-25 years	12.0 (0.0)	21.0 (0.0)
Social Control		
1-5 years	38.0 (0.0)	25.0 (12.73)
6-10 years	29.5 (14.84)	26.0 (14.54)
14-15 years	0.0 (0.0)	0.0 (0.0)
16-20 years	29.0 (0.0)	15.0 (0.0)
21-25 years	55.0 (0.0)	45.0 (0.0)

Q-LES-Q	Pretest	Posttest
Exercise		
1-5 years	44.27 (10.24)	47.27 (9.45)
6-10 years	42.0 (0.0)	43.0 (0.0)
14-15 years	0.0 (0.0)	0.0 (0.0)
16-20 years	0.0 (0.0)	0.0 (0.0)
21-25 years	60.0 (0.0)	60.0 (0.0)
Social Control		
1-5 years	36.0 (4.24)	48.0 (5.66)
6-10 years	42.75 (7.37)	41.0 (10.55)

14-15 years	0.0 (0.0)	0.0 (0.0)
16-20 years	37.0 (0.0)	56.0 (0.0)
21-25 years	30.0 (0.0)	32.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
1-5 years	43.36 (9.76)	43.55 (12.19)
6-10 years	48.0 (0.0)	43.0 (0.0)
14-15 years	0.0 (0.0)	0.0 (0.0)
16-20 years	0.0 (0.0)	0.0 (0.0)
21-25 years	32.0 (0.0)	32.0 (0.0)
Social Control		
1-5 years	56.0 (4.24)	46.0 (1.41)
6-10 years	45.75 (8.14)	35.5 (2.65)
14-15 years	0.0 (0.0)	0.0 (0.0)
16-20 years	34.0 (0.0)	34.0 (0.0)
21-25 years	57.0 (0.0)	65.0 (0.0)

Table 40: Confounder Analysis- Severity (Mean Scores and Standard Deviations)

IDS-SR	Pretest	Posttest
Exercise		
Score of 15-20	12.0 (1.63)	13.0 (8.37)
Score of 21-25	24.33 (6.03)	21.33 (0.58)
Score of 26-30	23.0 (0.0)	23.0 (0.0)
Score of 31-35	22.0 (0.0)	22.0 (0.0)
Score of 36-40	0.0 (0.0)	0.0 (0.0)
Score of 41-45	43.0 (6.25)	30.33 (12.22)
Score of 46-50	0.0 (0.0)	0.0 (0.0)
Score of 51-55	0.0 (0.0)	0.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	49.0 (0.0)	64 (0.0)
Social Control		
Score of 15-20	24.0 (0.0)	33.0 (0.0)
Score of 21-25	26.0 (0.0)	12.0 (0.0)
Score of 26-30	0.0 (0.0)	0.0 (0.0)
Score of 31-35	23.0 (8.49)	15.5 (0.71)
Score of 36-40	38.0 (0.0)	16.0 (0.0)
Score of 41-45	38.0 (0.0)	34.0 (0.0)
Score of 46-50	55.0 (0.0)	45.0 (0.0)
Score of 51-55	51.0 (0.0)	43.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	0.0 (0.0)	0.0 (0.0)

Q-LES-Q	Pretest	Posttest
Exercise		
Score of 15-20	55.5 (3.7)	53.75 (5.56)

Score of 21-25	41.0 (3.61)	47.33 (5.86)
Score of 26-30	46.0 (0.0)	54.0 (0.0)
Score of 31-35	61.0 (0.0)	61.0 (0.0)
Score of 36-40	0.0 (0.0)	0.0 (0.0)
Score of 41-45	34.67 (2.31)	(40.0 (6.56)
Score of 46-50	0.0 (0.0)	0.0 (0.0)
Score of 51-55	0.0 (0.0)	0.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	33.0 (0.0)	31.0 (0.0)
Social Control		
Score of 15-20	0.0 (0.0)	0.0 (0.0)
Score of 21-25	48.0 (0.0)	31.0 (0.0)
Score of 26-30	47.0 (0.0)	54.0 (0.0)
Score of 31-35	40.5 (4.95)	50.5 (7.78)
Score of 36-40	33.0 (0.0)	52.0 (0.0)
Score of 41-45	39.0 (0.0)	44.0 (0.0)
Score of 46-50	30.0 (0.0)	32.0 (0.0)
Score of 51-55	32.0 (0.0)	34.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	0.0 (0.0)	0.0 (0.0)

UCLA Loneliness	**Pretest**	**Posttest**
Exercise		
Score of 15-20	34.25 (7.41)	34.5 (6.86)
Score of 21-25	45.33 (2.31)	48.67 (5.13)
Score of 26-30	50.0 (0.0)	36.0 (0.0)
Score of 31-35	34.0 (0.0)	34.0 (0.0)
Score of 36-40	0.0 (0.0)	0.0 (0.0)
Score of 41-45	53.0 (9.17)	48.33 (18.34)

Score of 46-50	0.0 (0.0)	0.0 (0.0)
Score of 51-55	0.0 (0.0)	0.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	41.0 (0.0)	55.0 (0.0)
Social Control		
Score of 15-20	0.0 (0.0)	0.0 (0.0)
Score of 21-25	36.0 (0.0)	36.0 (0.0)
Score of 26-30	49.0 (0.0)	34.0 (0.0)
Score of 31-35	44.5 (14.84)	36.5 (3.54)
Score of 36-40	59.0 (0.0)	45.0 (0.0)
Score of 41-45	53.0 (0.0)	47.0 (0.0)
Score of 46-50	57.0 (0.0)	65.0 (0.0)
Score of 51-55	43.0 (0.0)	33.0 (0.0)
Score of 56-60	0.0 (0.0)	0.0 (0.0)
Score of 61-65	0.0 (0.0)	0.0 (0.0)

APPENDIX N

INDIVIDUAL DATA FOR THE IDS-SR, Q-LES-Q, AND THE REVISED UCLA LONELINESS SCALE

Table 41: Individual Subject Data for the IDS-SR

Subject	Group	IDS-0	IDS-6
1*	2	28	28
2	1	48	33
3	2	38	34
4*	1	11	11
5	1	49	64
6	1	18	21
7	2	51	43
8	2	38	16
9	1	22	22
10*	1	45	45
11	1	23	23
12	1	12	6
13	1	25	22
14	2	55	45
15	1	12	12
16*	2	30	30
17	1	10	25
18	2	24	33
19*	2	20	20
20	1	36	17
21	1	30	21
22	2	26	12
23*	2	21	21
24	2	17	16
25*	2	23	23
26	2	29	15
27*	1	37	37
28	1	14	9
29*	1	53	53
30	1	45	41
31*	2	28	28

Note: Group 1 = Group Exercise Intervention and Group 2 = Social Control Group
*** Indicates subjects who withdrew from participation. If 6-week data was not available, 0-week data was extrapolated to the 6-week data time point.**

Table 42: Individual Subject Data for the Q-LES-Q

Subject	Group	QLife-0	QLife-6
1*	2	47	47
2	1	36	39
3	2	39	44
4*	1	50	50
5	1	33	31
6	1	42	43
7	2	32	34
8	2	33	52
9	1	61	61
10*	1	36	36
11	1	46	54
12	1	53	56
13	1	44	45
14	2	30	32
15	1	60	60
16*	2	55	55
17	1	57	47
18	2	48	31
19*	2	50	51
20	1	36	47
21	1	37	54
22	2	47	54
23*	2	56	56
24	2	44	45
25*	2	34	34
26	2	37	56
27*	1	38	38
28	1	52	52
29*	1	20	20
30	1	32	34
31*	2	42	42

Note: Group 1 = Group Exercise Intervention and Group 2 = Social Control Group
*** Indicates subjects who withdrew from participation. If 6-week data was not available, 0-week data was extrapolated to the 6-week data time point.**

Table 43: Individual Subject Data for the Revised UCLA Loneliness Scale

Subject	Group	Lone-0	Lone-6
1*	2	24	24
2	1	55	42
3	2	53	47
4*	1	29	29
5	1	41	55
6	1	48	43
7	2	43	33
8	2	59	45
9	1	34	34
10*	1	55	55
11	1	50	36
12	1	28	26
13	1	44	53
14	2	57	65
15	1	32	32
16*	2	60	60
17	1	32	41
18	2	36	36
19*	2	38	38
20	1	43	34
21	1	44	50
22	2	49	34
23*	2	39	39
24	2	55	39
25*	2	44	44
26	2	34	34
27*	1	60	60
28	1	45	39
29*	1	69	69
30	1	61	69
31*	2	37	37

Note: Group 1 = Group Exercise Intervention and Group 2 = Social Control Group
*** Indicates subjects who withdrew from participation. If 6-week data was not available, 0-week data was extrapolated to the 6-week data time point.**

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