The Effect of a Combined Exercise and Recreation Therapy Program on Quality of Life in Post-Treated Female Breast Cancer Patients

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ABSTRACT

JILL LUCAS: The Effect of a Combined Exercise and Recreation Therapy Program on Quality of Life in Post-Treated Female Breast Cancer Patients
(Under the direction of Dr. Claudio Battaglini)

The primary purpose of this study was to examine the impact of a combined exercise and recreation therapy program on selected physiological and psychological parameters in post-treated breast cancer patients. A secondary purpose examined what physiological and psychological parameters caused the greatest magnitude of change in overall quality of life. It was found that a six-month combined intervention caused significant improvements in predicted VO_{2max}, overall muscular endurance, balance, fatigue, emotional self-efficacy, and quality of life. Predicted VO_{2max} and fatigue were the two parameters that explained the greatest amount of variance in quality of life. This study suggests that combined exercise and recreation therapy interventions are an effective way to improve both physiological and psychological factors in post-treated breast cancer patients. It is also suggested that future interventions consider concentrating on improving predicted VO_{2max} and fatigue in order to most efficiently and effectively increase quality of life in these patients.

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Chapter I

Introduction

Breast cancer is the most commonly diagnosed malignancy among American women. Because of improved detection and treatment options, the mortality rate from breast cancer has decreased, greatly increasing the number of survivors who are living with the disease and its side effects (Jones et al., 2007). Among the most common side effects are anemia, fatigue, pain, sleep disturbance, depression, and decreased memory.

Fatigue is the most common side effects reported in the cancer population, occurring in 72 to 95% of all cancer patients receiving or recovering from treatment (American Cancer Society, 2005). The fatigue that is cancer-related is described as a persistent feeling of exhaustion and a decreased mental and physical capacity that is not relieved by sleep or rest (Adamsen et al., 2004). Cancer-related fatigue differs from other types of fatigue in several ways. First, it is typically of greater duration and severity and is frequently associated with high levels of distress. Cancer-related fatigue is also disproportionate to the level of exertion put forth by the patient (Bardwell & Ancoli-Israel, 2008). The etiology behind the fatigue in cancer patients is not certain and may vary from patient to patient, however there are several mechanisms that are believed to be involved. Proposed mechanisms behind this fatigue include depression, personality characteristics, sleep disturbances, anemia, protein turnover, nutritional status, and inflammation (Bardwell &Ancoli-Israel, 2008; Dimeo, Thomas, Raabe-Menssen, Propper, & Mathias, 2004; Battaglini, Dennehy, Groff, Kirk, & Anton, 2006).

Due to the magnitude and variability of the changes that occur throughout the multiple organ systems, it is suggested that cancer-related fatigue is most likely the result of a multitude of factors. Because of its potentially debilitating effect, cancer-related fatigue can have a tremendous impact on a patient's quality of life.

A breast cancer patient's engagement in work and in personal and social activities is often reduced due to fatigue. Thus, there is a large increase in attention given by the National Institute of Health for the management and treatment of cancer treatment-related side effects, which includes the management and treatment of fatigue (Patrick et al., 2003).

Most cancer survivors have difficulty conducting normal day-to-day activities, including a decreased ability to perform household chores, run errands, climb stairs, and walk any substantial distance. These declines in functional ability frequently lead to a decreased quality of life among the survivors (Battaglini et al., 2006). The fatigue may also lead to cognitive dysfunction and post-exertional malaise that further exacerbate the decreased quality of life feelings (Dimeo et al., 2004). Frequently, the fatigue causes patients to avoid strenuous activities. This reduced level of activity results in a paradoxical relationship, however. Inactivity leads to fatigue in and of its self, while the fatigue leads to inactivity (Dimeo, 2001). In addition to fatigue, chemotherapy treatments can also damage the vestibular function of breast cancer patients and create peripheral neuropathies that may compromise balance in these individuals.

While many of the symptoms associated with breast cancer and its treatment can last for several months or even years after treatment is complete, studies have shown that regular physical activity is beneficial in reducing and relieving cancer-related symptoms and improving quality of life in cancer patients (Hong et al., 2006, Dimeo, 2001, Winningham &

MacVicar, 1988; Battaglini et al., 2006; Courneya et al., 2003; Shephard, 1993). In a review article by Galvao and Newton (2005), thirteen different studies involving breast cancer patients who performed exercise during cancer treatments showed improvements. Most of the studies incorporated a cardiovascular program with a few also including a resistance training and flexibility component. Improvements such as a decrease in fatigue, nausea, blood pressure, and emotional distress, as well as an increase in lean tissue mass, maximal oxygen consumption, and quality of life were observed throughout the studies.

While it is evident that exercise programs can have a positive impact on many of the side effects that cancer patients are commonly afflicted with, participation in exercise alone may not be enough to manage all of the symptoms. In an effort to further ameliorate the side effects of cancer, several other forms of therapy have been also been studied, including recreation therapy.

Recreation therapy is another tool that can be used to help cancer patients deal with their side effects both during and after their treatments (Battaglini et al., 2006). Recreation therapy has been used successfully in the hospital setting, helping a multitude of patients cope with their various illnesses. Koopman and colleagues (2002) states that individuals who are suffering from some illness or disability need to be exposed to some interventions to provide them with some tools they can use to reduce stress. Despite facing the death of other members of the group with the same illness, cancer patients enrolled in a recreation therapy program appeared less anxious and depressed, had less denial, and were less phobic at the end of the initial year then at the beginning. Control subjects who received routine care deteriorated emotionally throughout the period (Spiegel & Classen, 2000). It has also been found that recreation therapy is able to help a patient make a connection to their spirituality

through leisure, which may help a patient better cope with and recover from their illness (Groff, Battaglini, O'Keefe, Edwards, & Peppercorn, in press). Recreation therapy may also play a role in increasing emotional self-efficacy in cancer patients, or the emotional self-confidence that these women have to share their emotions, live in the present, and confront their fears (Giese-Davis et al., 2002).

Since the multitude of cancer and cancer treatment-related side effects impact the physical and psychological functioning of breast cancer patients, the use of exercise in combination with other interventions that focus on the psychosocial aspect of the disease and symptoms from treatment should be considered.

Statement of the Purpose

The purpose of the study was to examine the impact of a combined exercise and recreation therapy program on selected physiological and psychological parameters in post-treated breast cancer patients. A secondary purpose examined which physiological and psychological parameters caused the greatest magnitude of change in overall quality of life.

Hypotheses

H1: There will be a significant improvement in VO_{2Max} from baseline measures to the end of the study protocol measures.

H2: There will be a significant improvement in overall muscular endurance from baseline measures to the end of the study protocol measures.

H3: There will be a significant improvement in static balance from baseline measures to the end of the study protocol measures.

H4: There will be a significant decrease in fatigue from baseline measures to the end of the study protocol measures.

H5: There will be a significant improvement in emotional self-efficacy from baseline measures to the end of the study protocol measures.

H6: There will be a significant improvement in quality of life from baseline measures to the end of the study protocol measures.

H7: Fatigue will be the greatest predictor of variance on overall quality of life.

Definition of Terms

Recreation Therapy: the provision of planned treatment or therapy (i.e. health restoration, remediation, habilitation, rehabilitation), which uses recreation and activities as the primary medium of treatment for persons who are limited in theirs functional abilities due to illness, disability, maladaptation, or other conditions (NCRTA, 1992).

Fatigue: persistent feeling of exhaustion and decreased physical and mental capacity unrelieved by rest or sleep

Overall Muscular Endurance: a variable created by summing the number of repetitions recorder from the assessment of push-ups, partial curl-up, biceps curl, lat pulldown, leg extension and leg curl exercises.

Exercise: a stress placed on the body for the purpose of developing and maintaining physical fitness

Balance: physical equilibrium

Quality of Life: one's ability to enjoy normal life activities

Emotional Self-Efficacy: emotional self-confidence, including the ability to communicate feelings to significant others, the ability to face issues of death and dying, and the ability to remain focused in the present

Assumptions

1. All patients enrolled in the study strictly followed the pre-testing guidelines prior to reporting for testing.
2. The impact of different cancer treatments and drugs resulted in similar side effects experienced by the patients enrolled in the study.
3. Subjects honestly and accurately answered the questionnaires that will be used to assess fatigue, self-efficacy, and quality of life.
4. All subjects did not present any co-morbidities or orthopedic problems that could compromise performance in any of the fitness parameters that will be assessed during the study.

Delimitations

1. All subjects willingly volunteered to participate in the Get REAL & HEEL Breast Cancer Program and are residents in one of the 13 counties of the N.C. Triangle Affiliate of the Susan G. Komen Foundation.
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3. All subjects have been diagnosed with breast cancer and had completed cancer treatment within six months.

Limitations

1. The sub-maximal test used for the assessment of oxygen consumption (VO_2) may present some measurement error since some subjects may have never used a treadmill before and may feel uncomfortable performing the test.

2. Small sample size.

Significance of the Study

Exercise interventions have been used for some time with cancer patients in various stages of treatment with much success. Many of the side effects that occur as a result of cancer treatments are treatable with pharmacological therapies, however this treatment method often provides only temporary relief. While fatigue is generally one of the more concerning symptoms of the treatments, it has been proposed that many patients' lack of physical activity throughout their treatments may actually exacerbate the level of fatigue (Dimeo, 2001). This fatigue compromises the patients physical functioning, psychological well-being, and quality of life. Several studies have intervened in the cancer treatment and recovery process with physical exercise, leading to decreased rates of fatigue, enhanced physical performance, and an improved quality of life. These existing studies have utilized a variety of exercise prescriptions, with the majority incorporating some type of cardiovascular training and a few incorporating a mixed training program including cardiovascular, resistance, and flexibility exercises (Galvao and Newton, 2005).

Recreation therapy has been used in the hospital setting and has the ability to mitigate the psychological decline that is commonly observed in breast cancer patients. The therapy provides patients with an outlet for dealing with their emotions and alternative activities on which to focus their attention. Recreation therapy has also been shown to increase immune system activity, reduce pain, improve balance, and reduce feelings of depression, anxiety, and tension (NCRTA, 1992). When breast cancer survivors are suffering from the above symptoms, it is crucial that they have access to an outlet that will help them to deal with their symptoms, both physical and mental.

As exercise and recreational therapy have both been shown to have a positive effect on cancer patients, it makes sense that when used together to form a combined intervention, the results would be even more beneficial to the patient. Combining exercise and recreational therapy would allow for a patient's multidimensional needs to be addressed, not just their physical function but also their state of mind. Exercise training can act as a stress reliever but is not able to train the patient's mind as to better deal with negative emotions and feelings. Likewise, recreational therapy can improve one's well-being, making them more motivated to be physically active, but can't actually better a patient's function, stamina, or strength. Without the combination of the two therapies, however, the patient may not be receiving the best treatment possible. As the recovery from cancer can take a huge toll on both the physical and psychological state on a patient, it is vital to address both components. This study would be one of the first to explore the effect of a combined exercise and recreational therapy program on different physiological and psychological parameters usually negatively impacted during the cancer experience.

The analyses from this study will also assist in the understanding of which component(s) of a combined exercise and recreation therapy program are able to cause the greatest magnitude of change in a patient's quality of life. This is important because this knowledge will allow for future interventions to more specifically focus on and address those parameters that contribute the most to improvements in quality of life. As an improved quality of life is one of the main goals of participating in an intervention program, it is important that these programs focus their interventions most heavily on those parameters that will help their patients reach this goal most quickly and fully.

Chapter II

Review of Literature

Cancer is a disease where cells change and grow out of control. Regardless of where the cancer spreads to, if the disease originates in the breast tissue, it is called breast cancer (American Cancer Society, 2007). Breast cancer begins in either the lobules or ducts of the breast. From this point, the tumors are often invasive, spreading outside of the lobule or duct walls to infiltrate the surrounding tissues (American Cancer Society, 2007).

Breast cancer is characterized by its stage, ranging from stage 0 to stage IV. Stage 0 is the least severe and is known as carcinoma in situ. This stage of cancer only involves the lining of the lobule or duct and may or may not become an invasive form of breast cancer at a later stage (National Cancer Institute, 2007). Stage I is an early form of invasive breast cancer where the tumor is less than 2 centimeters across and is still contained within the breast tissue. Stage II cancer has several different possibilities. The tumor can either be no larger than 2 centimeters across but have spread to a lymph node in the underarm region, be between 2 and 5 centimeters and have not spread to any lymph nodes under the arm, be between 2 and 5 centimeters and have spread to lymph nodes under the arm, or else be larger than 5 centimeters but have not spread outside of the breast. Stage III is known as locally advanced cancer and is subdivided into three different subcategories: stage IIIA, stage IIIB, and stage IIIC. In stage IIIA breast cancer, the tumor is less than 5 centimeters across but has spread to the underarm lymph nodes that are attached to each other or other surrounding structures, or else the tumor is more than 5 centimeters across and has spread to underarm

lymph nodes. Stage IIIB cancer is characterized by a tumor that has spread to the lymph nodes behind the breastbone and under the arm, or the cancer has spread to the lymph nodes under or above the collarbone. Stage IIIC breast cancer includes a tumor of any size that has spread to the lymph nodes behind the breast bone and under the arm or has spread to lymph nodes above or below the collarbone. Stage IV is the most serious form of cancer and is distant metastatic cancer where the disease has spread to other parts of the body (National Cancer Institute, 2009).

Breast cancer is the most commonly diagnosed cancer in women (excluding skin cancer), accounting for one in four cases of cancer diagnosed in US women (American Cancer Society, 2009). Although relatively uncommon, breast cancer can also occur in males. It was estimated that 182,460 new cases of breast cancer would be diagnosed in US women in 2008, while approximately 40,480 deaths would occur as a result of the disease in the same year (National Cancer Institute, 2009). The National Cancer Institute (2009) estimates that a woman born today in the United States has a 12.7% chance of being diagnosed with breast cancer at some point in her lifetime.

Cancer Treatments and Potential Side Effects

While many American women are being diagnosed with breast cancer, current advances in treatment have shown promising effects on the treatment of the disease and in decreasing the mortality rate. Current treatment options of breast cancer include chemotherapy, radiation therapy, surgery, and/or hormonal therapy. Although these treatments can serve their intended purpose of ridding the body of cancer, they also come with a wide array of side effects. Chemotherapy treatment is often associated with nausea, vomiting, hair loss, cardiotoxicity, shortness of breath, low red and white blood counts,

mouth sores, fatigue, trouble concentrating and focusing, exercise intolerance and weight change (Zachariae et al., 2007; Turner-Gomes et al., 1996; American Cancer Society, 2009; Hsish et al., 2008). Radiation therapy also has its share of potential side effects, including fatigue, nausea, vomiting, skin changes, interstitial myocardial fibrosis, and coronary and carotid artery arteriosclerosis (American Cancer Society, 2009; Hsieh et al., 2008). Surgery to the chest region may lead to a reduced range of motion at the shoulder as well as wound infection, a buildup of fluid in the wound, change in the shape of the breast, and fatigue (American Cancer Society, 2009; Hsieh et al., 2008). Hormonal therapy can result in hot flashes, headaches, and blood clots (National Cancer Institute, 2009).

In addition to the aforementioned side effects, a breast cancer diagnosis and its treatments can also result in numerous other potential symptoms. These may include but are not limited to fatigue, decreased physical functioning, decreased quality of life, pain, sleep disturbances, weight gain or loss, somatic distress, cachexia, and depression (Galvao and Newton, 2005; Dimeo, 2001; Pinto, Trunzo, Reiss, & Shiu, 2002; Babyak et al., 2000; Battaglini et al., 2006). These symptoms often place additional stress upon a breast cancer patient that can result in poor treatment outcomes. A wide array of pharmaceutical agents exist to help manage many of these symptoms, however they are often expensive and only provide temporary relief to the patient.

Cancer Treatment and Fatigue

One of the more complex and troubling side effects of cancer treatments is fatigue. According to the American Cancer Society, anywhere from 72 to 95% of all cancer patients experience some degree of cancer treatment-related fatigue. The fatigue that is associated with cancer is described as a persistent feeling of fatigue that appears during normal

activities, is unrelieved by rest and may become severe enough to force the patient to reduce their level of activity (Dimeo, 2001). This fatigue is believed to be much more complex than the fatigue associated with athletes following an intense bout of exercise. It has a multi-dimensional etiology including these possible factors: pain, electrolyte and fluid disturbances, anemia, impaired nutritional status, weight loss, sleep disturbances, drug interactions, depression, and anxiety (Dimeo, 2001). Because cancer-related fatigue is unrelieved by rest and often manifests itself in conjunction with other troublesome symptoms, fatigue can have a large impact on a patient's quality of life (Bardwell & Ancoli-Israel, 2008; Adamsen et al., 2004; Pinto et al., 2002).

In an effort to avoid fatigue in the cancer population, it used to be recommended that patients rest and avoid physical effort and activity. This advice resulted in a paradoxical problem, as extended periods of rest induce muscle wasting that lower endurance and strength that leads to further fatigability. This became a self-perpetuating problem where fatigue led to inactivity and the inactivity led to greater fatigue (Dimeo et al., 1997).

Although fatigue and physical performance are related variables, it has become evident that they are not identical phenomena. Dimeo and coworkers (2004) found that a daily aerobic training program consisting of 30 minutes of interval cycling training fives times per week resulted in substantial improvements in maximal physical performance but did not improve fatigue anymore than progressive relaxation training, suggesting that they are independent factors.

An observational cohort study by Windsor and associates found that fatigue levels did significantly increase from baseline through the course of treatment for various types of cancer. Subjects with breast cancer were shown to have higher fatigue scores as compared to

subjects with genitourinary or gynaecological cancers. Information on cancer, cancer treatment-related fatigue, and exercise was provided to all subjects and anecdotal evidence, as well as written responses on surveys, showed that most patients were able to exercise throughout treatment and found it to be a satisfying and enlightening experience. It also seemed to alleviate some patients' fatigue (Windsor, Potter, McAdam, & McCowan, 2009).

Quality of Life in Cancer Patients

Throughout the diagnosis and treatment phases of breast cancer, many patients suffer from a decreased quality of life. Quality of life is defined as overall pleasure, comfort, and enjoyment in one's life (Bicego et al., 2008). Like fatigue, decreased quality of life stems from a multitude of different factors, both physiological and psychological in nature. According to a 2003 study by Courneya and coworkers, significant morbidities that undermine one's quality of life occur as a result of both the disease and its treatments. Psychosocial issues may include anxiety, depression, anger, cognitive decline, low self-esteem, loneliness, and a loss of sense of control. Physical problems may include diminished cardiovascular function, decreased strength, weight gain or loss, reduced range of motion, difficulty sleeping, nausea, and pain. These symptoms may persist for several months or even years post-treatment, thus continuing to impact one's quality of life (Courneya et al., 2003).

Over the past several years, several complementary alternative treatments that address many of the aforementioned symptoms have been studied with positive results. These complementary treatments include exercise, relaxation training, nutritional support, supplements, support groups, and mind-body healing (Dimeo et al., 2004; Greenlee et al., 2009; Courneya et al., 2003). These additional treatments may help to reduce both the

physiological and psychological symptoms that are associated with cancer. Until recently, most cancer patients were advised to rest and avoid strenuous activity during their recovery from the disease and its treatments. Through the work of many scientists, however, it has become evident that exercise therapy has very promising results in this population (Courneya et al., 2003; Dimeo et al., 2004; Courneya et al., 2001; Pinto, Clark, Maruyama, & Feder, 2003; Battaglini et al., 2006; Pinto et al., 2002; Adamsen et al., 2004).

Exercise therapy as a complementary alternative treatment

Although numerous studies exist that demonstrate the positive effects of exercise training with the breast cancer population, these studies vary greatly as to the exercise protocols, dosages, and time of treatment used. Many also fail to accurately report the actual exercise prescription used in the intervention. In a review of exercise intervention studies by Galvao and Newton (2005), twenty-six studies were reviewed, with eighteen of them administering some form of exercise intervention during treatment and the remaining eight prescribing exercise post-treatment. Of the eighteen studies completed during treatment, fourteen included some form of cardiovascular training, which generally consisted of cycling, walking, or arm ergometry. The intensity, frequency, and duration of these programs varied greatly. In a Winningham and colleagues study from 1988, patients cycled with interval training for twenty to thirty minutes, three times per week between 60 and 85% of their maximal heart rate. Schwartz (1999, 2000) had their twenty-seven patients walk for thirty-five minutes at a self-selected pace four times per week. Segal and associates. (2001) compared a home vs. non-home based walking program where the patients walked five times per week at an intensity between 50 and 60% of their VO_{2max}.

Of the remaining of the eighteen reviewed studies, two implemented a mixed cardiovascular, resistance, and flexibility training program while the final two applied a structured resistance training-only program (Galvao and Newton, 2005). Kolden and associates (2002) and Adamsen and coworkers (2003) both examined the effect of a combined cardiovascular, resistance, and flexibility program. Kolden and colleagues had patients exercise three times per week at unspecified intensities, but including cardiovascular walking, cycling, and stepping. Adamsen and associates exercised patients four times per week with resistance training including three sets of five to eight repetitions at 85-95% of their 1-RM. The cardiovascular component of the program included cycling between 60 and 100% of the patient's maximal heart rate. Of the two studies that used only a resistance training program, one included two sets of twelve repetitions between 60 and 70% of 1-RM three times per week (Segal et al., 2003) while the other occurred three to five times per week at an unspecified intensity and dosage (Cunningham et al., 1986). In the review of exercise intervention studies by Galvao and Newton (2005), eight studies were reviewed where the exercise intervention took place after cancer treatment. Similar to the during treatment studies, the post-treatment studies also varied greatly. Cardiovascular training varied from cycling at approximately 60% of maximal heart rate (Peters, Lotzeirich, Niemeier, Schule, & Uhlenbruck, 1994; Peters, Lotzeirich, & Niemeir, 1995) to walking for thirty minutes at a lactate concentration of 3mmol/L (Dimeo et al., 1997). Resistance training protocols in these studies were largely unspecified.

A 2008 study by Hsieh and coworkers. demonstrated significant improvements in VO_{2max} and treadmill time following a six-month supervised exercise intervention involving aerobic exercise, resistance training, and flexibility. Participants were broken into groups

depending upon treatments received and participated in exercise sessions two or three times per week. Revised Piper Fatigue Scales were also administered in this study, with several areas of the scale showing significant improvements across all treatment groups (Hsieh et al., 2008).

Although the majority of the existing studies on exercise therapy interventions with the breast cancer population do not agree on prescriptions, almost all of them show positive effects and none of them demonstrate any negative consequences associated with the intervention. In general, the studies included in Galvao and Newton's review showed a decrease in nausea, body fat, fatigue, and emotional distress. Increases were shown in lean tissue mass, VO_{2max}, quality of life, strength, and performance (Galvao and Newton, 2005). According to Battaglini and colleagues, exercise may be beneficial to cancer patients in the following ways: increase appetite, stimulate erythrocyte production, increase protein synthesis, improve connective tissue integrity, improve mobilization and removal of cellular metabolites and toxins, enhance energy production, improve cardiovascular efficiency, improve proprioception, reduce pain, and increase self-esteem, body self-perception, and increase social interaction (Battaglini et al., 2006). A study on older women with breast cancer who were receiving hormonal therapy found a significant improvement in serotonin levels and sleep patterns after a 12-week walking program.

In a chapter of *Methods of Molecular Biology*, *Cancer Epidemiology*, Reigle and Wonders explored the role of exercise in the prevention of breast cancer, throughout breast cancer treatments, and in preventing a recurrence of the disease. In the prevention of breast cancer, it has been found by numerous studies that regular physical activity may have a protective effect. Although the specific dosage of physical activity necessary for a risk

reduction is currently undetermined, a moderate level of activity seems adequate. Specific mechanisms for this risk reduction are also unclear, but there are several proposed mechanisms. In some studies, physical activity is associated with a smaller body size and with less body fat, which leads to a reduction in substrate for the production of estrogen from androstenedione in fat tissue. Estradiol may also be reduced through physical activity by an increased level of sex hormone-binding globulin. As breast cancer is an estrogen-dependent disease, lower exposure to the hormone may be beneficial in reducing one's risk for the disease. According to Reigle and Wonders, another possible mechanism may involve lipid peroxidation and the production of reactive oxygen species. It is possible that exercise may induce oxidative stress and subsequent apoptosis of premalignant and malignant cells of the breast. Benefits have also been seen in patients participating in exercise during treatment. Reigle and Wonders reiterate that although exercise seems to have many positive effects, there is no consensus on the ideal dosage, modality, or even timing of intervention in relation to treatments. In breast cancer survivors, studies are also promising on helping to prevent recurrence, however maintaining an exercise regimen long term presents a significant challenge (Reigle & Wonders, 2009).

While some studies do show improvements in quality of life and psychological well-being as a result of an exercise intervention, the results are somewhat equivocal across the entire body of literature in relation to psychological symptoms (Dimeo et al., 2004, Pinto et al., 2002; Courneya et al., 2003). Pinto and colleagues (2002) performed a 12-month longitudinal study investigating exercise trends of breast cancer survivors and its effect on quality of life and mood. Although very few survivors met recommended exercise guidelines, exercise participation was associated with improved physical functioning, but not

overall mood. A two-group study consisting of an aerobic exercise group and a progressive relaxation group both produced improvements in several of the factors on a quality of life scale, however there were no significant differences between the two groups (Dimeo et al., 2004). If exercise alone is not able to fully address all psychological symptoms associated with breast cancer and its treatments, perhaps other interventions, such as recreation therapy, may be able to assist patients in dealing with these symptoms.

Recreation therapy as a complementary alternative treatment

In an attempt to further ameliorate some of the psychological symptoms that breast cancer patients suffer from, recreation therapy has been employed. The Leisure and Well-Being Model (Carruthers & Hood, 2007) is based on the theory that recreation therapy can impact an individual's well-being in a positive manner by enhancing one's ability to participate in leisure activities. The Leisure and Well-Being Model focuses on individuals' problems, deficits and negative experiences, as well as their strengths, capacities, and positive experiences. When these factors are considered together, each of them provides a description of a patient's resilience, well-being and quality of life (Groff et al., in press). Thus, numerous different interventions aimed at improving psychosocial well-being can be applied through this model.

Recreation therapy is the provision of planned treatment or therapy, which uses recreation activities as the primary medium of treatment for persons who are limited in their functional abilities due to illness, disability, maladaptation, or other conditions (NCRTA 1992). There are many different recreation therapy activities that have been utilized in the clinical setting with little data confirming their positive benefits. In a study by Bordeleau and coworkers, a group psychosocial support group for metastatic breast cancer patients

failed to improve health-related quality of life (Bordeleau et al., 2003). Marchioro and colleagues administered a psychological intervention to a group of non-metastatic breast cancer patients and found improvements in both depression and quality of life, as well as better emotional coping skills as compared to a control group (Marchioro et al., 1996). A psychosocial treatment intervention including self-hypnosis for pain in a group of women with metastatic breast cancer found a mean survival rate of 36.6 months for the intervention group and only 18.9 months for the control group (Spiegel, Bloom, Kraemer, & Gottheil, 1989). In a different form of recreation therapy, Sabiston, McDonough, and Crocker interviewed a group of woman involved with a dragon boat program for survivors and found that the program facilitated social support and provided the women with an opportunity to gain a sense of personal control, to gain a new identity as an athlete, and to overcome physical challenges (Sabiston et al., 2007).

More recently, technology has advanced the field of recreation therapy, including biofeedback software programs such as HeartMath. Biofeedback is a type of alternative medicine known as mind-body therapy. Biofeedback is based on the idea, confirmed by scientific studies, that people have the innate potential to influence with their minds many of the automatic, involuntary functions of their bodies. The technique uses signals from special monitoring equipment to teach you to control certain body functions and their responses, such as brain activity, blood pressure, muscle tension, heart rate, skin temperature, or sweat gland activity (Mayo Clinic, 2008). In a Korean study by Kim and colleagues, breast cancer patients with a mastectomy who received abdominal breathing training using biofeedback saw an improvement in quality of life. A pre-test, post-test design with an experimental and group was used. The experimental group received abdominal breathing training once a week

for four weeks. They showed decreases in state anxiety, cancer-related symptoms, and serum cortisol, but these differences were not significantly different from the control group. The improvements in quality of life in the experimental group were significant (Kim et al., 2005).

The HeartMath software helps an individual regulate their heart rate coherence and heart rate variability. Heart rate coherence is a measure of the order, harmony, and stability of mental and emotional processes in the body (McCraty & Tomasino, 2006). Heart rate variability is a measure of the naturally occurring beat-to-beat changes in heart rate (McCraty & Tomasino, 2004). The Institute of HeartMath has accumulated a large body of research exhibiting the potential psychological and physiological benefits that can come with increasing one's heart rate coherence and variability. These benefits include decreased stress, increased positive emotions, enhanced cognitive performance and clarity, improved immune function, and improved emotional stability (McCraty, 2001; McCraty & Tomasino, 2006; Von Ah, Kang, & Carpenter, 2007).

Psychometric measurements for use in the cancer population

Regardless of the form of recreation therapy, several assessments and questionnaires exist in order to measure psychological states. One of these assessments is the Stanford Emotional Self-Efficacy Scale-Cancer. Self-efficacy is one's emotional self-confidence and this scale measures this characteristic in the face of a serious illness. The greater one's self-efficacy, the fewer anxiety or trauma symptoms they tend to experience (Ozer & Bandura, 1990; Wood & Bandura, 1989), the quicker they rebound from dysphoria (Salovey, Mayer, Goldman, Turvery, & Palfai, 1995), the less pain and suffering they undergo (Bandura et al., 1987), and the more satisfaction they can achieve with social relationships (Greenberg, 1993). A few studies have also shown that self-efficacy in confronting and managing affect

in highly emotional situations might also affect endocrine and immune functioning (Pennebaker, Kiecolt-Glaser, & Glaser, 1988; Wiedenfeld et al., 1990).

The Stanford Emotional Self-Efficacy Scale-Cancer is a scale that was designed to assess self-efficacy in three different domains that are believed to be important in the cancer population. These three domains include the ability to communicate feelings to significant others, the ability to face issues of death and dying, and the ability to remain focused in the present. The scale includes 15 items that are rated in 10-point increments on a scale ranging from 0 (no at all confident) to 100 (completely confident). The total score is the mean response across all 15 items on the 0-100 point scale (Koopman et al., 2002). One study using the Stanford Emotional Self-Efficacy Scale-Cancer in a group of women with metastatic breast cancer who participated in supportive-expressive group therapy found that the overall 12-month linear model was significant ($p < .001$) but that the difference between the treatment and control groups was only marginally significant ($p = .055$), with the women in the treatment group not declining in emotional self-efficacy over 12 months as compared with women in the control group (Giese-Davis et al., 2002).

The Functional Assessment of Cancer Therapy-Breast (FACT-B) is a 44 item instrument that is designed to measure the multidimensional quality of life in breast cancer patients. FACT-B scores can range from 0-148 with the higher the score indicating the greater the overall quality of life. A breast cancer diagnosis and its related treatments can lead to a reduced quality of life. In women with metastatic breast cancer, current treatments are not curative and thus the quality of a patient's survival may be as important as the length of the survival. Quality of life issues among the breast cancer population include such factors as pain, fear of recurrence, fatigue, an altered sense of feminity, feelings of decreased

attractiveness, and problems associated with treatment-related arm swelling. Numerous scales exist that attempt to quantify a patient's quality of life, but they all have their drawbacks. Some scales are too specific to breast cancer and thus cannot be compared to different cancer sites and treatments. Other more general scales may fail to capture some breast cancer-specific quality of life issues (Brady et al., 1997).

The FACT-B is actually a compilation of a general scale and the addition of a subscale specific to breast cancer. The general FACT (FACT-G) is multidimensional, consisting of subscales assessing physical well-being, emotional well-being, social well-being, functional well-being, and relationship with doctor. The breast cancer subscale is comprised of nine items specific to quality of life in breast cancer that are not already included in the FACT-G.

In a study on a group of breast cancer survivors from Western Australia, women with higher self-reported physical activity levels and with lower body mass indexes had a greater quality of life, as indicated by the FACT-B (Milne, Gordon, Guilfoyle, Wallman, & Courneya, 2007). A dance and movement program set-up for breast cancer survivors created an increase in FACT-B quality of life as compared to the wait-listed control group (Sandel et al., 2005). Suh (2007) utilized the FACT-B and found that education, income, job, and stage of disease were significantly associated with quality of life in breast cancer patients. Mood, income, and fatigue were significant predictors for quality of life, while stress was not. This study verified that both physical and psychological factors are strong predictors of quality of life in breast cancer patients.

As previously discussed, fatigue is a significant and complex problem among breast cancer patients and survivors. The Revised Piper Fatigue Scale has been shown to be an

effective measure of assessing fatigue in breast cancer patients (Piper et al., 1998). The 22-question scale, which is divided into four different subscales, involves ranking each item on a scale of 0-10, where higher scores indicate greater fatigue. The four subscales are behavioral/severity, sensory, cognitive/mood, and affective meaning. Studies have demonstrated that fatigue is significantly higher in women with stage II breast cancer receiving adjuvant chemotherapy then a group of cancer-free women matched with age, ethnicity, and menopause status (Thompson, 2007). Thompson also demonstrated that fatigue levels drop somewhat following the completion of treatments but fatigue still remains at a moderate level for some time post-treatments.

The Use of a Combined Exercise and Recreation Therapy Intervention on Breast Cancer Patients

While it is evident that both exercise therapy and recreation therapy interventions can have a positive effect on breast cancer patients and survivors, few studies have combined the two interventions in order to investigate a more multi-dimensional approach. Courneya and coworkers compared the effects of a group psychotherapy-only intervention to a group psychotherapy plus home-based exercise program intervention in a group of cancer survivors. Subjects were randomly assigned to one of the two intervention groups. Participants in the group therapy only group were asked not to begin an exercise program and were not given an exercise prescription. This group was reminded that they would be given an exercise prescription at the conclusion of the study, however. The exercise plus group therapy group received a 30-minute fitness consultation to follow at home for about ten weeks. Each week, an exercise report was collected. The personalized exercise programs included walking at least three to five times per week, for 20-30 minutes, at 65-75% of their

estimated heart rate maximum. A subject could substitute an alternative form of exercise for walking, if they desired. The group therapy sessions met once per week for 90 minutes at a time and included stress management, relaxation training, and expressive-supportive therapy. A total of 96 subjects completed the program and provided post-intervention data. The group psychotherapy plus exercise group had significant improvements in sum of skinfolds, fatigue, functional well-being, and quality of life over the psychotherapy-only group, while other tested conditions, such as physical well-being, emotional well-being, anxiety, and treadmill time did not differ significantly between groups (Courneya et al., 2003).

Dimeo and coworkers found an improvement in physical performance in a group who underwent exercise training as compared to a group who participated in relaxation training. A group of 72 post-surgical patients were randomly divided into an aerobic exercise or relaxation training group. The aerobic exercise group biked on a stationary bike for 30 minutes daily for five days each week following an interval-training pattern. Intervals progressed from 5 x 3 minutes for the first week, followed by 4 x 5 mintues in the second week, and 3 x 8 minutes for the third week. Pedal rate was about 50 cycles per minute. Training intensity corresponded to a heart rate of about 80% maximal heart rate in the stress test. The relaxation training sessions included the Jacobson method of progressive muscle relaxation, where a muscle is contracted for five seconds then relaxed for thirty seconds, during which the subject focuses on breathing. These sessions were held three times per week for a total of three weeks. Each session took approximately 45 minutes. Although a difference in physical performance was noted, no differences in fatigue were found between the two groups (Dimeo et al., 2004). These results suggest that although fatigue and physical performance are related concepts, they are independent of each other. This study utilized

lung and gastrointestinal cancer patients, not breast cancer patients.

Due to the success found in the cancer population with both exercise therapy and recreation therapy interventions, but the lack of research investigating a combined intervention, especially in the breast cancer population, it has become necessary to study the effects of such an intervention in this population.

Chapter III

Methodology

Study Design

This was a one group study to examine the impact of a combined exercise and recreation therapy intervention on selected physiological and psychological parameters in post-treated breast cancer patients. A secondary purpose of this study examined what changes in selected physiological and psychological parameters caused the most change in overall quality of life.

The Get REAL & HEEL Breast Cancer program involves a combined exercise and recreation therapy intervention aimed at addressing physiological and psychological needs of women who have completed treatment for breast cancer. The exercise component of Get REAL & HEEL includes individualized prescriptive exercise including cardiovascular activities on the treadmill, cycle ergometer, and elliptical machine, resistance exercises with exercise machines, dumbbells, rubber bands, and fit balls, and a variety of flexibility exercises designed to assist patients in re-gaining upper body flexibility and a full range-of-motion in the arm, which are generally compromised by surgery.

The recreation therapy component of the program consists of a host of recreation activity techniques designed to accomplish the psychological and well-being goals and objectives identified in the patient's individual treatment plans. Some of the recreation therapy interventions include: cognitive and behavioral interventions for pain and stress

management, relaxation training, creative writing, expressive arts, humor therapy, leisure counseling, journaling, values clarification, and biofeedback techniques.

Post-treated breast cancer patients are enrolled in the program for 6 months. Each patient is assigned to an exercise specialist and/or recreation therapist, trained by the Department of Exercise and Sport Science. These specialists then assess, design, and administer all exercise and recreation therapy sessions under the supervision of professors and physicians from the University of North Carolina at Chapel Hill. All sessions are hosted at the Get REAL & HEEL Breast Cancer Program facility in the Department of Exercise and Sport Science, at the University of North Carolina at Chapel Hill.

This is a retrospective study where data was collected for patients that were enrolled and completed the six-month Get REAL & HEEL Breast Cancer Program between 2006 and 2007.

Study Protocol

Recruitment of Subjects

After an introduction to the Get REAL & HEEL program by an oncologist and/or nurse, patients with an interest in participating in the program were asked to contact the research team. An advertisement flier was provided to physicians and nurses with a contact phone number. If a patient showed interest and called for more information, they received more in-depth clarification concerning the program protocol and specifics on enrollment. In order to screen the patient for participation eligibility, a visit to the program facility was scheduled during the phone call, as well as an appointment for completing initial assessments. It was requested that patients fax their medical oncologist's approval for participation in the study prior to the first visit to the Get REAL & HEEL Breast Cancer

Program facility. On the first visit to the Get REAL & HEEL Breast Cancer Program, a screening was performed and confirmation for participation by a medical oncologist was verified. Additionally, the informed consent approved by the University Review Board and the HIPPA authorization for use and disclosure of health information for research purposes was obtained. A meeting was set up between the program director and each patient in order to review the subject's medical history and to clarify any questions the subject may have had about their participation in the program and the study protocol. On a subsequent visit, the participant was put through a series of physical and psychological assessments that would be used to develop an exercise and recreation therapy intervention that they would participate in three times a week for a period of six months. All physiological and psychological assessments were repeated at the completion of the intervention. The same protocols used for the baseline assessments were used for the post-assessments.

Subjects

Volunteers for the study consisted of 19 women who had completed all major treatments for breast cancer (surgery, chemotherapy, and/or radiation) within the past six months. All women enrolled to participate in the Get REAL & HEEL program between the years of 2006 and 2007 were enrolled in this study at the University of North Carolina at Chapel Hill, Department of Exercise and Sport Science.

The criteria for participation in the study included: confirmed diagnosis of stage I, II, or III invasive breast cancer; be within six months of completion of all planned surgery, radiation therapy and chemotherapy; and an age range from 30 to 75 years. Patients receiving adjuvant hormonal therapy or adjuvant trastuzumab (such as Tamoxifen, Herceptin, and etc.) were also eligible. Patients were excluded from participating in the study if they presented

with any of the following conditions: cardiovascular, acute or chronic respiratory disease (unless the disease would not compromise the patient's ability to participate in the exercise rehabilitation program); acute or chronic bone, joint, or muscular abnormalities that would compromise the patient's ability to participate in the exercise rehabilitation program; inadequate renal function with creatine < 1.5 mg/dL; immune deficiency that would compromise the patient's ability to participate in the program (Absolute Neutrophil Count (ANC) < 1.5μL, Platelet (Plt) < 90 GL (900,000 mm^3), and/or Hematocrit (Hct) < 30%); or metastatic disease.

Assessment Protocols

The assessment protocols administered to all subjects during this study included demographic data as well as a battery of psychological and physiological tests. All assessments were administered at baseline and at the end of the study (month 6) and were administered by trained research team members at the Get REAL & HEEL program facility. The psychological assessments included: Fact-B Quality of Life questionnaire, the Revised Piper Fatigue scale, and the Stanford Emotional Self-Efficacy Scale – Cancer. Physiological assessments included: resting vitals (resting heart rate (RHR), blood pressure (BP), and pulse oximetry for the determination of hemoglobin saturation), body height and weight, body composition, cardiorespiratory endurance (Modified Bruce treadmill protocol), muscular endurance (Rocky Mountain Cancer Rehabilitation Institute submaximal muscular strength protocol, hand-held grip dynamometry, standardized push-up and partial curl-ups) (Heyward, 2006), flexibility (Modified sit-and-reach box), and static balance through the single leg stance (Goldie, Bach, & Evans, 1989; Lipsitz, Jonsson, Kelley, & Koestner, 1991; Weiss, Suzuki, Bean, & Fielding, 2000).

Description of the assessment protocols:

Psychological assessments

Changes in psychological parameters were evaluated using the validated scales/questionnaires cited above for all subjects. All questionnaires that were used in this study were administered by program directors and co-investigators.

The Revised Piper Fatigue Scale is a self-administered questionnaire with 22 questions in four subscales. These subscales include behavioral/severity, affective meaning, sensory, and cognitive/mood. Scores range from 0-10 with 0 equivalent to no fatigue and 10 indicating the greatest amount of fatigue possible. The Revised Piper Fatigue Scale has been shown to be an effective, reliable, and valid measurement of assessing fatigue in breast cancer patients (Piper et al., 1998; Fu, LeMone, McDaniel, & Bausler, 2001; Thompson, 2007; Wielgus, Berger, & Hertzog, 2009). The scale has a standardized alpha of 0.98 (Piper et al., 1998).

The Functional Assessment of Cancer Therapy-Breast (FACT-B) is another self-reported tool, which uses 44 items to measure quality of life in breast cancer patients with a multi-dimensional approach. FACT-B scores range from 0-148, with the higher scores indicating a greater overall quality of life. The alpha coefficient, indicative of internal consistency, of the FACT-B is high at 0.90, with subscale alpha coefficients ranging from 0.63 to 0.86. The test-retest correlation coefficient for the total score is 0.85 (Brady et al., 1997).

The Stanford Emotional Self-Efficacy Scale for cancer is a 15-item questionnaire that measures emotional self-confidence in the face of a serious illness, such as cancer. Each item is answered on a scale of 0 (indicating not at all confident) to 10 (completely confident).

The alpha level for the total score is 0.89 and the test-retest correlation coefficient for the total score is 0.69.

Physiological assessments

Resting heart rate was assessed via a Polar Heart Rate monitor. After the heart rate monitor was in place around the midchest, subjects were asked to remain seated for approximately 5 minutes. During those 5 minutes, the lowest heart rate measure observed was recorded. Following measurement of the subject's resting heart rate, blood pressure was assessed using an aneroid sphygmomanometer and a stethoscope. Hemoglobin saturation was the last resting vital parameter assessed and was measured with a finger pulse oxymeter. Following the assessment of resting vitals, weight and height were obtained using a balance beam physician scale equipped with height rod. Body composition analyses were performed via skinfold thickness measurements following generalized three-site skinfold equations for females, as recommended by the American College of Sports Medicine in 2006.

Cardiorespiratory endurance was predicted via the modified Bruce protocol on a treadmill. The modified Bruce protocol was chosen for several reasons, including its appropriateness for high-risk populations and because of the minimal amount of stress it imposes on patients (Heyward, 2006). The Bruce protocol correlation coefficient is $r = 0.91$ with a standard error of estimate of 2.7 mL/kg/min. A heart rate of 75% of the predicted maximal heart rate was calculated using the Karvonen method to determine the point of termination during the modified Bruce protocol test.

Muscular endurance was assessed using a variety of tests, including a submaximal protocol from the Rocky Mountain Cancer Rehabilitation Institute (Greeley, CO), which requires subjects to perform repetitions of specific exercises until a RPE of 7 is reached using

a predetermined percentage of their body weight, calculated according to their age and sex. Also, a standardized push-up and partial curl-up test were used to complement the battery of exercises used to assess muscular endurance and strength. A summation of repetitions performed across all exercises was used as the overall muscle endurance score.

Static balance was assessed using the single limb stance test. During this test, all subjects were asked to stand on one leg for 30 seconds with their arms folded across their chest, their eyes closed, and their shoes removed. Before each test, the subject observed the tester demonstrating the correct test position and it was explained that the subject could choose which leg they would prefer to use. Total time that the subject was able to maintain the single leg stance was measured using a digital stopwatch. Time began when the subject achieved a single limb stance and ended when the lifted ankle touched the supporting limb, the supporting limb moved on the floor, the lifted foot touched the floor, either arm moved from the starting position, or the subject opened their eyes. A total of three trials were performed, with the mean time being recorded. A time of 0.00 seconds was recorded if the subject was unable to achieve a single limb stance.

All physiological assessments were performed by the primary and/or co-investigators, trained medical personnel, or a trained student from the University of North Carolina, Department of Exercise and Sport Science.

Exercise and Recreation Therapy Interventions

The program required all subjects to participate in a combination of exercise and recreation therapy protocol three times per week for a period of six months. Each exercise/recreation therapy session lasted no for approximately 90 minutes. For the first month of the intervention, subjects received 30 minutes of recreation therapy and 30 minutes

of exercise. During months two and three, subjects received 45 minutes of exercise and 25 minutes of recreation therapy. For the fourth and fifth month, 60 minutes of exercise two times per week and one 60 minute recreation therapy session were provided. Finally, in the sixth month, subjects participated in 60 minutes of exercise three times per week. This progression was followed because in the first month, subjects were too debilitated to participate in more than 30 minutes of exercise at a time. With improvements in fitness, however, the exercise time lengthened. Also, during the sixth month, subjects participated in educational sessions where they learned how to develop their own training plan after the completion of the program. Recreation therapy time decreased over the course of the six months as subjects mastered the skills and concepts that the therapy was providing. An individual treatment plan was developed for each person. This was done in an effort to accommodate the various needs and individual interests of the participants. The specific exercise and recreation therapy activities identified in the treatment plan were selected based on four criteria: a) an analysis of the assessment instruments and the associated needs of the individual based on those results, b) from an analysis of the literature that defines the expected outcomes of specific interventions, c) from an analysis of the professional experiences and expertise of the clinician, and d) from consideration of the desires of the individual once they have consulted with the therapists and discussed possible options and the potential benefits that may be derived from various interventions.

Exercise Therapy Protocol

Individualized exercise prescriptions were designed in accordance with the recommendations of the American College of Sports Medicine exercise guidelines for elderly populations (ACSM, 2006) and specific guidelines published in Exercise and Cancer

Recovery (Schneider, Dennehy, & Carter, 2003) for all subjects. These guidelines were utilized because of the wide age-range of the participants in this study and because of a lack of specific guidelines for the cancer population. The ACSM's and Exercise and Cancer Recovery's guidelines have been found to be appropriate for the participants of the Get REAL & HEEL breast cancer program.

All subjects were monitored on a daily basis by trained exercise physiologists, athletic trainers, and recreation and physical therapists. Daily training logs were used to record and monitor subject's progress within the exercise and recreation therapy interventions.

All exercises were performed at sub-maximal intensities that were determined according to the results of their initial physical assessments. Intensities varied between 40% and 75% of a predicted maximum exercise capacity for each type of exercise. The exercise intervention included several components, including cardiovascular exercise, resistance training, and flexibility exercises. Each exercise session began with aerobic activity, followed by a full-body stretching session, resistance training, and a cool down period that included additional stretching activities. These three components were included in each training session in accordance with the American College of Sports Medicine's (2006) guidelines for promoting overall beneficial physiological responses.

For the resistance component of the exercise session, 8-12 different resistance exercises were prescribed, so that all major muscle groups were stressed. The resistance exercises were performed using a combination of weight machines, free weights (hand dumbbells), elastic bands, or therapeutic balls (fit balls). Possible resistance exercises included: lateral and frontal raises (shoulder specific exercises), horizontal chest press, lat

pull down, alternating biceps curls with dumbbells, triceps extension, leg press, leg extension, leg curl, standing calf raises and three different types of abdominal exercises (regular crunches, oblique crunches, and lower abdominal). Progression of the resistance training exercises followed the ACSM guidelines (2006) for increases in load. Exercises were performed at an intensity that elicited a rating of perceived exertions (RPE) on the Modified Borg Scale of between three and seven. The number of repetitions for each exercise ranged from 6-12 repetitions, and could vary from session to session, depending on the physical state of the subject during each exercise session. A maximum of three sets of each exercise were performed at each session. At the onset of the program, subjects performed only one set of each exercise that were prescribed for the sessions. Subjects progressively advanced to perform two to three sets for each exercise during the following weeks and maintained those sets for the remainder of the program. A moderate speed was used for each exercise (three seconds of the concentric phase and three seconds of the eccentric phase of the movement during each repetition). The rest interval period between each set and between each exercise varied from thirty seconds to one minute, or according to subject's needs so that they could successfully complete all sets.

Possible cardiovascular activities included walking on a treadmill, riding a cycle ergometer, or using an elliptical machine. Every exercise session included the previously mentioned three components, as well as exercise/shoulder rehabilitation. For all subjects, each exercise session included these proportions of all components, based on time: cardiovascular workout: 20%, resistance Training: 60%, flexibility: 5%, and shoulder rehabilitation: 15%.

Recreation Therapy Protocol

All recreation therapy interventions were conducted in accordance with the Leisure and Well-Being Model (Carruthers & Hood, 2007). This model allows for a very individualized approach to therapy, as it takes into account the individuals' problems, deficits and negative experiences, as well as their strengths, capacities, and positive experiences. Through consideration of all of these factors, this model attempts to determine a person's resilience, well-being and quality of life. The theory that recreation therapy impacts one's psychological well-being in a positive manner through enhancement of an individual's leisure experiences and by enhancing their resources and capacity to engage in life activities is the basis for the Leisure and Well-Being Model. Leisure and life experiences are enhanced through five guiding principles including: savoring leisure, authentic leisure, leisure gratification, mindful leisure, and virtuous leisure. The five focuses for resource development are psychological resources, social resources, cognitive resources, physical resources, and environmental resources (Groff et al., in press).

For each subject, the results of their initial assessment were used to develop an individualized recreation therapy program, similar to the way that an exercise prescription was developed. The recreation therapy intervention was based on the clients needs in each of the five guiding principles listed above. All recreation therapy interventions were administered by a certified/licensed recreation therapist or under their direct supervision. Possible recreation therapy activities used during this study included: expressive arts/creative writing/journaling, humor therapy, leisure counseling, pain management, stress management and relaxation training, and biofeedback techniques using HeartMath®, Healing Rhythms, and emWave PC.

HeartMath®, Healing Rhythms, and emWave PC are software programs that aim to instruct individuals to increase their heart rate coherence. Each of the three software packages can be used to help individuals develop a personal stress relief technique. The programs aid individuals to gain awareness of their heart rate coherence during various emotional states and then to give them tips to help regulate their coherence. At each session, a small sensor was placed on the subject's earlobe, which allowed for monitoring of heart rate and rhythms. Visual and/or audible "feedback" was then provided through the program as to what was occurring inside of the subject's body. Recreation therapy sessions were administered on the same days as exercise training and included a thirty minutes session three times per week.

Instrumentation

Heart rate was assessed using a Pacer Polar heart rate monitor (Lake Success, NY). Blood pressure was assessed using a Diagnostix 700 aneroid sphygmomanometer (Hauppauge, NY) and Litmann stethoscope (St. Paul, MN). A Sport Stat finger pulse oxymeter (Plymouth, MN) was used for the assessment of hemoglobin saturation. Height and weight were assessed using a balance beam physician scale equipped with a height rod (Health-o-meter 402KL Rye, NY). Cardiovascular endurance was assessed using the modified Bruce treadmill protocol (Quinton Q65 treadmill, Fitness Equipment, Bothell, WA). Muscular endurance was assessed using a sub-maximal testing protocol designed at the Rocky Mountain Cancer Rehabilitation Institute using selectorized (Magnum Fitness Retro Series Machine, South Milwaukee, WI) machines and dumbbells (Power Systems Sports, Knoxville, TN). In order to assess flexibility of the hamstrings and lower back, a modified sit and reach box was utilized (Acuflex I, Novel Products, Inc., Rockton, IL). Recreational

therapy was performed using emWave PC biofeedback software (HeartMath®, Boulder, CA) and Healing Rhythms biofeedback system (Wild Divine, San Diego, CA).

Statistical Analysis

All data was gathered and entered into an electronic database for analysis. Descriptive statistics are presented in the form of means and standard deviations. The alpha level was set to *a priori* at 0.05 for the analysis of the impact of a combined exercise and recreation therapy program on selected physiological and psychological parameters.

H1: There will be a significant improvement in predicted $VO2_{Max}$ from baseline measures to the end of the study protocol.

H2: There will be a significant improvement in overall muscular endurance from baseline measures to the end of the study protocol.

H3: There will be a significant improvement in static balance from baseline measures to the end of the study protocol.

H4: There will be a significant decrease in fatigue from baseline measures to the end of the study protocol.

H5: There will be a significant improvement in emotional self-efficacy from baseline measures to the end of the study protocol.

H6: There will be a significant improvement in quality of life from baseline measures to the end of the study protocol.

For the analysis of hypotheses 1-6, paired samples t-tests were used. Values obtained for each variable at baseline were compared to values obtained at the end of the study, at month 6.

H7: Fatigue will be the greatest predictor of variance on overall quality of life.

Hypothesis 7 was tested using a multiple linear regression. The variables included in the regression model included the delta scores (post measurement – baseline measurement) obtained from the analyses of predicted VO_{2max}, overall muscular endurance, static balance, fatigue, emotional self-efficacy, and the FACT-B questionnaire at baseline and at the end of month 6 (post measurement).

Chapter IV

Results

The purpose of this study was to examine the impact of a combined exercise and recreation therapy program on selected physiological and psychological parameters in post-treated breast cancer patients. A secondary purpose examined what changes in selected physiological and psychological parameters are most associated with changes in quality of life. All data collected in this study was entered into an electronic database and analyzed using SPSS version 16.0 for Windows, a statistical software package. An alpha level of 0.05 was set for all statistical procedures. For one subject's missing baseline self-efficacy score, a missing value imputation procedure was used for all analyses that included this variable. The value was replaced by an estimate calculated by a mean computation of the non-missing values of this variable. Descriptive statistics are presented in the form of means and standard deviations.

Subjects

This study included 19 female subjects, ranging in age from 39 years to 71 years (mean = 52.6), all of which were post-treated breast cancer patients. Subjects were recruited from the 13 counties of the N.C. Affiliate of the Susan G. Komen Foundation, through physician referral and oncology practices and hospitals. Characteristics are presented in Table 1 below.

Table 1. Subject Characteristics

	Age (years)		Body Weight (kilograms)		Height (centimeters)		Body Composition (% body fat)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Post Treated Breast Cancer Patients n= 19	52.58	9.05	71.39	17.81	162.85	5.80	28.16	4.73

Hypothesis One

Hypothesis one, there will be a significant improvement in predicted VO_{2max} from baseline measures to the measures taken at the end of the study protocol, was analyzed using a paired samples t-test. The predicted VO_{2max} results (expressed in ml/kg/min) obtained from tests performed at baseline and post-intervention measures were used for the analysis. At baseline, the mean±standard deviation for predicted VO_{2max} was 26.6±4.3 ml/kg/min, as compared with 30.8±4.8 ml/kg/min post-intervention.

A statistically significant difference was observed between the baseline and post-intervention measures of VO_{2max} ($p < 0.0005$). Table 2 presents the results of the t-test used to analyze hypothesis 1.

Table 2. Results of paired-sample t–test performed for Hypothesis 1

	Paired Differences					
Mean (ml/kg/min)	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Baseline VO_{2max} vs. Post-Intervention VO_{2max}	4.19	2.93	0.67	-6.23	18	.000

Hypothesis Two

Hypothesis two, there will be a significant improvement in overall muscular endurance (OME) from measures taken at baseline to those taken at the end of the study protocol, was analyzed using a paired-samples t-test. The overall muscular endurance results (a summation of repetitions performed across all exercises) obtained from tests performed at baseline and post-intervention measures were used for the analysis. At baseline, the mean±standard deviation of OME was 63.89±31.65 reps compared with 143.64±30.07 reps post-intervention.

A statistically significant difference was observed between baseline and post-intervention measures of overall endurance ($p < .0005$). Table 3 presents the results of the t-test used to analyze hypothesis 2.

Table 3. Results of paired-sample t–test performed for Hypothesis 2

	Paired Differences					
	Mean (repetitions)	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Baseline OME vs. Post-Intervention OME	79.74	25.61	5.88	-13.57	18	.000

Hypothesis Three

Hypothesis three, there will be a significant improvement in static balance from measures taken at baseline to those taken at the end of the study protocol, was analyzed using a paired samples t-test. The static balance results (measured in total seconds) obtained from tests performed at baseline and post-intervention were used for the analysis. At baseline, the

mean±standard deviation of static balance was 4.60±3.56 seconds compared with 10.92±10.37 seconds post-intervention.

A statistically significant difference was observed between baseline and post-intervention measures of static balance ($p = .002$). Table 4 presents the results of the t-test used to analyze hypothesis 3.

Table 4. Results of paired-sample t–test performed for Hypothesis 3

	Paired Differences					
	Mean (seconds)	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Baseline Balance vs. Post-Intervention Balance	6.32	7.69	1.76	-3.58	18	.002

Hypothesis Four

Hypothesis four, there will be a significant decrease in fatigue from measures taken at baseline to those taken at the end of the study protocol, was analyzed using a paired samples t-test. The fatigue results obtained at baseline and post-intervention measures were used for the analysis. Fatigue scores at baseline were 4.54±1.70 compared to 2.23±2.20 post-intervention.

A statistically significant difference was observed between baseline and post-intervention measures of fatigue ($p < .0005$). Table 5 presents the results of the t-test used to analyze hypothesis 4.

Table 5. Results of paired-sample t–test performed for Hypothesis 4

	Paired Differences					
	Mean (Scores)	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Baseline Fatigue vs. Post-Intervention Fatigue	-2.31	2.15	0.49	4.67	18	.000

Hypothesis Five

Hypothesis five, there will be a significant improvement in emotional self-efficacy from measures taken at baseline to those taken at the end of the study protocol, was analyzed using a paired samples t-test. The emotional self-efficacy results obtained from tests performed at baseline and post-intervention were used for the analysis. At baseline, the mean±standard deviation of emotional self-efficacy was a score of 71.02±21.16 compared with 83.97±23.17 post-intervention.

A statistically significant difference was observed between baseline and post-intervention measures of emotional self-efficacy ($p = .010$). Table 6 presents the results of the t-test used to analyze hypothesis 5.

Table 6. Results of paired-sample t–test performed for Hypothesis 5

	Paired Differences					
	Mean (Scores)	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Baseline Emotional Self-Efficacy vs. Post-Intervention Emotional Self-Efficacy	12.96	19.56	4.49	-2.89	18	.010

Hypothesis Six

Hypothesis six, there will be a significant improvement in quality of life (QOL) from scores taken at baseline to those taken at the end of the study protocol, was analyzed with a paired samples t-test. The scores obtained through the FACT-B, the instrument used for the analyses of quality of life, at baseline and post-intervention were used for the analyses of hypothesis 6. Mean quality of life scores at baseline were 105.75±19.58 compared to 124.07±19.61 post-intervention.

A statistically significant difference was observed between baseline and post-intervention scores of quality of life ($p < .0005$). Table 7 presents the results of the t-test used to analyze hypothesis 6.

Table 7. Results of paired-sample t–test performed for Hypothesis 6

	Paired Differences					
	Mean (Scores)	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Baseline QOL vs. Post-Intervention Balance	18.31	18.51	4.25	-4.31	18	.000

Hypothesis Seven

Hypothesis seven, fatigue will be the greatest predictor of variance on quality of life after controlling for all other variables, was analyzed using a multiple linear regression model where the delta scores (post measure – pre measure) of predicted VO_{2max} (VO2), overall muscular endurance (OME), static balance (BAL), fatigue (FAT), and self-efficacy (EFF) (independent variables) and the delta scores of quality of life (QOL) (dependent variable)

were the variables used in the regression model. The descriptive statistics of the multiple linear regression are presented in Table 8.

Table 8. Descriptive statistics for the multiple linear regression

	Mean Delta Scores	Standard Deviation	N
QOL	18.31	18.51	19
FAT	2.31	2.15	19
EFF	12.96	19.56	19
BAL	6.32	7.69	19
VO_2	4.19	2.93	19
OME	79.74	25.61	19

The results of the multiple linear regression are presented in Table 9. The total model was statistically significant with p = .007.

Table 9. Results of multiple linear regression between quality of life and the independent variables VO_2, OME, BAL, FAT, and EFF

	R	R^2	Adjusted R^2	Standard Error of the Estimate	df	F	Significance
Model 1	0.821	0.675	0.549	12.425	18	5.391	0.007
VO_2	0.482	0.233					0.004
OME	0.149	0.022					0.759
BAL	0.313	0.098					0.073
FAT	0.474	0.224					0.026
EFF	0.361	0.131					0.304
Model 2	0.733	0.537	0.479	13.366	18	9.264	0.002
VO_2							0.005
FAT							0.005

(Predictor: QOL)

After analyzing the data using a multiple linear regression, predicted VO_{2max} and fatigue were the only independent variables that accounted for a significant amount of the variance in overall quality of life. The overall model (model 1) with all five original independent variables included, accounted for 67.5% of the change in quality of life in post-treated breast cancer patients. When a second model was run through the regression (model 2) where all non-significant variables were removed from the model and significant factors were entered into a new model, predicted VO_{2max} and fatigue both remained significant and

accounted for 53.7% of the change in quality of life, with each variable contributing almost equally (27.2% and 26.4%, respectively).

Chapter V

Discussion, Conclusion, and Recommendations

This study had two purposes. The first purpose of this study was to examine the impact of a combined exercise and recreation therapy program on selected physiological and psychological parameters in post-treated breast cancer patients. A secondary purpose examined what changes in selected physiological and psychological parameters are most associated with changes in quality of life.

Breast cancer is the second most diagnosed cancer among American women and also the second leading cause of cancer death in this population (American Cancer Society, 2009). Improved detection methods and treatment options have led to a decrease in the mortality rate from this disease, causing the number of breast cancer survivors to escalate (American Cancer Society, 2009). There are currently an estimated two and a half million survivors living in the United States. Because the disease process and its treatments are associated with a wide array of side effects that can last well beyond the actual course of the disease, it has become more and more evident that breast cancer survivors need continued treatments to help them cope with the lasting side effects and also to assist them in returning to a normal life. Several forms of complementary alternative treatments have shown positive results in the rehabilitation of breast cancer survivors. Among these treatments are exercise therapy and recreation therapy. Existing research on both of these forms of treatment has shown a reduction in numerous side effects and improvements in quality of life (Hong et al. 2006,

Dimeo et al., 2001; Winningham et al., 1988; Battaglini et al., 2006; Courneya et al., 2003; Shephard, 1993; Galvao and Newton, 2005), however little work has been done with combining these two forms of treatment into a multi-factorial treatment approach that would aim to address the whole patient, both physiologically and psychologically.

The subjects used in this study were a group of 19 female breast cancer survivors between the ages of 39 and 71 years. All subjects had diagnosed stage I, II, or III breast cancer and had completed all major treatments within the past six months. All of the women were enrolled in the Get REAL & HEEL Breast Cancer Rehabilitation program at the University of North Carolina at Chapel Hill between the years of 2006 and 2007. The program consisted of a six-month treatment program where participants received treatment three times each week. Sixty minutes of each session consisted of exercise and the remaining thirty minutes was used for recreation therapy. The exercise portion of the intervention included aerobic exercise, resistance training, and flexibility with each subject following an individually prescribed exercise plan, based on assessments performed at baseline. The recreation therapy intervention was also customized to the subject's individualized needs and included activities such as expressive arts/creative writing/journaling, humor therapy, leisure counseling, pain management, stress management and relaxation training, and biofeedback techniques including HeartMath®, Healing Rhythms, and emWave PC.

The Impact of the Combined Exercise and Recreation Therapy Intervention on Physiological Parameters

Oxygen Consumption (Predicted VO_{2max})

Significant improvements in predicted VO_{2max} were observed in this group of post-treated breast cancer patients after participating in a combined exercise and recreation

therapy intervention. Although the exact mechanisms explaining why improvements in oxygen consumption occur in the breast cancer population remain elusive, the improvements most likely occurred as a result of one or more of the physiological adaptations that occur when the cardiorespiratory system is stressed through exercise. During exercise training, working skeletal muscles use more than 80% of the oxygen that is consumed. Maximum oxygen uptake is an indicator of the maximum working capacity of both the cardiopulmonary and muscular system involved in the aerobic process from the delivery of atmospheric oxygen to the mitochondria of the muscle fibers. Thus, increases in maximum oxygen uptake brought about by exercise training involving large muscle mass is mostly attributable to an improvement of cardiopulmonary function, but also of blood oxygen transport and muscle aerobic capacity (McArdle, Katch, & Katch, 2001). According to Brooks, Fahey, and Baldwin (2005), aerobic exercise is best for improving the capacity of the cardiovascular system. Aerobic exercise sessions should last for at least 15 to 20 minutes and take place at least three times per week at an intensity above 50 to 60% of VO_{2max}. Although the subjects in this study may have had to work up this exercise dosage over the course of the program, eventually it was the goal to have all subjects reach this level or higher.

Some of the adaptations that occur with this type of training and may have lead to the increases in predicted maximal oxygen consumption in this population include an increase in blood volume, plasma volume, and venous return. The heart also improves its ability to pump blood with aerobic training, mainly by increasing its stroke volume through a greater heart volume and contractility. The vasculature throughout the body is improved, with increased microcirculation and greater capillarization within the muscles. The greater volume of blood that is pumped throughout the body as a result of training, in addition to the

increased circulation capabilities, enhances the a-vO_2 difference, meaning that a greater amount of oxygen can be extracted from the blood into the muscles which increases one's oxygen consumption, or VO_{2max} (Brooks et al., 2005; McArdle et al., 2001). This study used a submaximal treadmill test that was based off of heart rate to estimate maximal oxygen consumption. Thus, the lower resting heart rate and lower heart rate at a given submaximal intensity that occurs with training would also be beneficial in improving predicted VO_{2max} with this method of estimation (McArdle et al., 2001).

Additionally, it has been found that exercise training preserves intrinsic cardiovascular function following treatment with various chemotherapeutic agents. The cardioprotective effects are associated with an exercise-induced increase in endothelial nitric oxide synthase, myocardial heat shock protein content, and attenuation in chemotherapy-induced myocardial lipid peroxidation (Chicco, Schenider, & Hayward, 2006; Hayward et al., 2004). Thus, several different mechanisms may have contributed to the physiological adaptation of increased predicted VO_{2max} (Hsieh et al., 2008).

Previous studies that included predicted VO_{2max} testing in breast cancer patients and survivors also showed improvements over the course of a training period (MacVicar, Winningham, & Nickel, 1989; Kolden et al., 2002; Adamsen et al., 2003; Hsieh et al., 2008). MacVicar and associates found a 42% increase in VO_{2max} with an interval cycling training program three times per week for ten weeks. Kolden and colleagues implemented a three times per week program including walking, cycling, stepping, resistance training, and flexibility training for sixteen weeks, which produced a 15.4% improvement in VO_{2max}. Through a combination program of resistance training, cycling, and relaxation training, Adamsen and coworkers saw a 16% improvement in VO_{2max} over the course of a six-week

program. Hsieh and partners divided their subject group by treatment type(s) received and implemented a two to three time per week whole body aerobic, resistance, and flexibility training program for six months. The program was individualized and supervised by certified cancer exercise specialists. All groups experienced a significant improvement in predicted VO_{2max}, with the surgery only treatment group having a 23% change, the surgery and chemotherapy group having a 15.2% increase, the surgery and radiation therapy group had a 19.7% improvement, and the group that received all treatments (surgery, radiation therapy, and chemotherapy) showed a 18.9% increase over the course of the six month intervention (Hsieh et al 2008). Courneya and associates (2003) observed a 17.4% increase in peak oxygen consumption after a structured training intervention. MacVicar and coworkers (1989) found between a 15 and 23% increase in predicted VO_{2max} across all treatment groups following a 10-week interval training cycle ergometer protocol.

The combined exercise and recreation therapy program used in this study showed a 15.7% increase in predicted VO_{2max}, similar to the results seen in many of the existing literature's results. The group of breast cancer survivors used in this study actually had a fairly high mean predicted VO_{2max} among the breast cancer population. This may be a reason why the improvements seen in oxygen consumption were similar to but sometimes slightly lower than those seen in other studies. There may have been less room for improvement. The pre-intervention mean predicted VO_{2max} in this study was 26.64 mL/kg/min, as compared to Hsieh and colleague's 20-21 mL/kg/min. It is also difficult to compare specific numbers across literature, as there are currently many different testing protocols in use, including many that use power output on an ergometer instead of a graded treadmill test (Dimeo et al., 2004). Existing research also shows the potential for submaximal treadmill

tests to overestimate VO_{2max} in women, which could further explain the discrepancy (Hartung, Blancq, Lally, & Krock, 1995).

Overall Muscular Endurance

Significant improvements in overall muscular endurance were observed in this group of post-treated breast cancer patients after undergoing a 6-month combined exercise and recreation therapy intervention. In this study, overall muscular endurance is representative of a summation of the total number of repetitions completed on a set of exercises including the Rocky Mountain Cancer Rehabilitation Institute submaximal muscular strength protocol, hand-held grip dynamometry, standardized push-up and partial curl-ups. There are several possible mechanisms for the improvements seen in overall muscular endurance in this study. Early improvements in strength gain are seen as a result of enhanced neural facilitation, without an increase in muscle size or cross sectional area. The neural adaptations occur by influencing the effects of the following factors: greater efficiency in neural recruitment patterns, increased central nervous system activation, improved motor unit synchronization, lowering of neural inhibitory reflexes, or inhibition of the Golgi tendon apparatus. In addition to the early neural adaptations, other physiologic adaptations continued to occur throughout the six-month training program, which may have also led to the improvement of overall muscular endurance. With resistance training, the size of muscle fibers will begin to increase, which is known as hypertrophy. Although hypertrophy will be limited in this population because the subject pool was all female and the intensity of the resistance training was limited, hypertrophy will still occur to some extent. Also, there will be an increase in enzymes involved in metabolism, such as creatine phosphokinase, myokinase, and

phosphofructokinase. Intramuscular fuel stores may also increase, including sources such as adenosine triphosphate, phosphocreatine, and glycogen (McArdle et al., 2001).

A review of clinical trials found that a multitude of resistance training programs caused only rare adverse effects (generally musculoskeletal in nature), did not aggravate lymphedema, and were able to provide both health-related and clinical benefits to breast cancer patients and survivors (Milne, Wallman, Gordon, & Courneya, 2008). A study by Schneider and coworkers found significant improvements in upper body, lower body, and core endurance with concomitant improvements in depression and quality of life following a six-month resistance training intervention. The intervention included 135 breast and prostate cancer patients who participated in 60 minutes of exercise two or three times per week for a total of six months. Resistance training exercises included resistance tubing, Cybex variable weight machines, and dumbbells. Aerobic training was also included, with the possibilities of outdoor or treadmill walking, recumbent stepping, or stationary cycling. Those with low fitness began at an intensity between 30 and 45% of heart rate reserve, while those with moderate fitness started between 50 and 60% of heart rate reserve (Schneider, Hsieh, Sprod, Carter, & Hayward, 2007). The duration, protocol, and overall results of this study were similar to the results found in this study, without the recreation therapy component. Although studies do agree that a resistance training program is beneficial in the breast cancer population and are able to improve overall muscular strength and endurance, it is difficult to compare results among studies. Each study utilizes different assessment protocols and expresses their results in a varying manner. The overall muscular strength and endurance results in this study are expressed as a total summation of several different exercises which cannot be compared to results of individual exercise results found in some other studies. The

actual exercises used in the existing studies vary substantially as well. In this study, however, there was a mean improvement of about 125%, which follows the trend created by existing work that substantial improvements can be made.

It was important to see such an improvement in this group of patients for several reasons. First, having greater muscular endurance will allow for these women to be able to carry out their activities of daily living more safely, efficiently, and easily. Picking up objects, becoming more mobile, and other tasks such as cleaning and gardening all involve a certain amount of muscular strength and endurance, which may have been very limited in these women prior to the intervention. Also, resistance training leads to a greater amount of muscle mass, thus raising one's basal metabolic rate (McArdle et al., 2001; Brooks et al., 2005). This adaptation will increase the number of calories that the survivors use on a daily basis. The greater number of burned calories is useful because weight gain is a common problem among breast cancer survivors that can lead to other potentially dangerous comorbidities, such as hypertension and diabetes (Heideman, Russell, Rookus, & Voskuil, 2009).

Balance

Significant improvements in balance were observed in this group of post-treated breast cancer patients after undergoing a combined exercise and recreation therapy intervention. A condition called chemotherapy-induced peripheral neuropathy may occur in some breast cancer patients as a result of chemotherapy treatment with certain drugs, such as Taxol or Taxotere. This condition involves damage to the peripheral nervous system which transmits information to the central nervous system and may lead to balance problems in these patients, due to a decrease in overall muscular function (Cancer Supportive Care,

2008). In addition to the neuropathies, the effects of chemotherapy on vestibular function may also be a reason for the balance and postural control issues that chemotherapy patients can suffer from.

There is no existing literature studying balance as a primary outcome in cancer patients, however it is a very important parameter that needs to be studied more thoroughly. Improvements in balance can have a large impact on the survivors' overall daily living. Enhanced balance creates confidence in the survivors to go about their daily activities without fear of losing their balance and injuring themselves, which would create a major setback. A better sense of balance also allows the women to participate in a wider variety of exercise and recreation therapy activities. The option of a greater number of activities creates a more through, fun, and potentially beneficial intervention.

The Impact of a Combined Exercise and Recreation Therapy Program on Psychological Parameters

Fatigue

Fatigue is a multidimensional symptom that is very common among breast cancer patients and survivors. The American Cancer Society reports that 72 to 95% of all cancer patients receiving or recovering from treatment experience fatigue to some degree. About 30% of cancer survivors report that the impairment of physical functioning that occurs as a result of their fatigue persists for years after the conclusion of treatments (Dimeo, 2000). Combinations of multiple treatment modalities appear to cause a more profound fatigue (Battaglini et al., 2006). The fatigue that is expressed in cancer patients should be addressed differently than fatigue that the healthy population would have from exercise, according to Battaglini and colleagues (2006). With athletes who experience chronic fatigue as a result of

heavy training, rest and a reduction in exertion level are the recommended treatments. Rest as a treatment for cancer-related fatigue may actually intensify the fatigue, although many patients do place a self-imposed reduction in activities upon themselves. Possible mechanisms of the debilitating fatigue are endocrine changes, lack of energy, lack of strength, lack of sleep or sleep disturbances, pulmonary changes, cardiovascular changes, nausea and vomiting, loss of appetite, psychological stress, inflammation, immune system dysregulation such as increased production of pro-inflammatory cytokines, and anemia (Battaglini et al., 2006; Bardwell & Ancoli-Israel, 2008; Dimeo et al., 2004). As is evident by the myriad of potentially involved mechanisms, cancer-related fatigue is both a physical and psychological problem.

Significant decreases in fatigue were observed among this group of post-treated breast cancer patients after participating in a combined exercise and recreation therapy intervention program. Exercise training is known to enhance energy production, improve mobilization and removal of cellular metabolites and toxins, and stimulate erythrocyte production (Battaglini et al., 2006), all of which could aid in reducing fatigue. Impaired physical performance is also associated with fatigue. The improvements in physical performance that accompany an exercise training program, such as the one used in this study, may lead to the decreases in fatigue (Dimeo et al., 2004). Recreation therapy has also been shown to helpful in reducing fatigue by addressing the psychological factors associated with the debilitating symptom. This type of therapy may help to reduce stress, depression, and anxiety, all symptoms strongly associated with fatigue. Therefore, therapies that reduce global stress and anxiety and improve mood may decrease fatigue (Dimeo et al., 2004).

Numerous existing studies have shown reductions in fatigue after an intervention similar to the one employed in this study (Dimeo et al., 2004; Bardwell & Ancoli-Israel, 2008; Adamsen et al., 2004; Dimeo, 2000; Battaglini et al., 2006; Hsieh et al., 2008). Dimeo and colleagues found a substantial reduction in fatigue with an exercise program yet the fatigue reduction with this program was not greater than after progressive relaxation training (Dimeo et al., 2004). This study used lung and gastrointestinal cancer patients, not breast cancer patients, yet still showed that an exercise intervention could improve physical performance and fatigue levels. It is also evident that physical performance and fatigue are independent factors, as performance improved more than fatigue. Fatigue scores obtained via the Revised Piper Fatigue Scale in the current study were similar to scores recorded in Hsieh and coworker's study that utilized the same assessment scale. Hsieh and associates (2008) had a group of breast cancer survivors participate in supervised exercise sessions two or three days per week for six months. A whole body, individualized exercise approach was used, including aerobic exercise, resistance training, and stretching. Intensity ranged from 40 to 75% of heart rate reserve. This study found a total mean fatigue score of between 4.89 and 5.40 pre-exercise, depending on treatment-received grouping. In the current study, the total mean fatigue score pre-intervention was 4.54. The post-intervention mean fatigue score in this study was 2.23, as compared to Hsieh and colleagues, which varied from 2.96 to 3.63. The difference in the post-intervention scores suggest that the recreation therapy component of the combined intervention added an extra benefit over an exercise therapy-only intervention as Hsieh et al. utilized. Payne, Held, Thorpe, and Shaw found a mean fatigue score of 4.28, which did not significantly change over the course of a walking intervention (Payne et al., 2008). Fatigue probably did not significantly change in this study for two

reasons. First, this study used a group of older women who generally do not receive very close surveillance. Second, all exercise was self-reported so it is difficult to determine what physical activity was actually performed. The mean fatigue score was close to the mean fatigue score pre-intervention found in this study, however with a mean of 4.28, compared to the current study's 4.54 at baseline. An eight-week long, one time per week mixed-type exercise program at moderate intensity improved mean fatigue scores from 4.9 to 3.8 in a study by Turner, Hayes, and Reul-Hirche (2004). A study involving an exercise and relaxation breathing program with a group of stem cell transplant cancer patients found an initial fatigue level of 6.075. This level was reduced to 2.93 following the exercise and breathing therapy (Kim & Kim, 2003). Although the fatigue values in this study were higher than those seen in the current study, both show remarkably similar reductions in fatigue. The Kim and Kim study showed a 52% reduction and the current study had a 51% reduction. These two studies strongly suggest that a combination of exercise and some form of recreation therapy reduce fatigue levels more than exercise-only interventions.

Emotional Self-Efficacy

Emotional self-efficacy is the emotional self-confidence that someone possesses. This characteristic involves awareness, tolerance, and acceptance of one's own emotional reactions combined with the confidence to use this emotional information to act on one's own behalf (Greenberg & Safran, 1987; Greenberg, Wortman, & Stone, 1996). In the face of cancer, emotional self-efficacy includes the ability to utilize strong emotional reactions in traumatic situations, to focus one's thoughts and actions, to communicate distress to others, and to become fully aware of potential future dangers (Gottman, Katz, & Hooven, 1996; Greenberg, 1993; Greenberg et al., 1996). People with higher emotional self-efficacy tend to

experience fewer anxiety and trauma symptoms (Ozer & Bandura, 1990; Wood & Bandura, 1989), rebound quicker from dysphoria (Salovey et al., 1995), experience less pain and suffering (Bandura et al., 1987), and achieve more satisfaction with social relationships (Greenberg, 1993). Emotional self-efficacy may also affect endocrine and immune functioning (Pennebaker et al., 1988, Wiedenfeld et al., 1990).

When faced with adversity and a potentially life-threatening situation, people tend to experience adverse emotions and avoid other feelings and experiences that they may find frightening or difficult. As is evident by the existing literature, however, having a high degree of emotional self-efficacy not only is beneficial when coping psychologically with a disease, such as breast cancer, but may also have some physiological benefits. Breast cancer patients may have low emotional self-efficacy but interventions that aid them in improving this skill may be very helpful in improving their outlook on life, their quality of life, and their disease state. While full-blown post-traumatic stress disorder is rare among women diagnosed with breast cancer, related trauma symptoms such as intrusion and avoidance are relatively common, with more than 20% of primary breast cancer patients experiencing high levels of intrusion and avoidance (Koopman et al., 2002).

This study found a significant improvement in emotional self-efficacy in a group of post-treated breast cancer patients following a combined exercise and recreation therapy intervention. It is unclear exactly which component(s) of the intervention assisted in improving emotional self-efficacy, however it is speculated that the recreation therapy component of the intervention contributed most to the improvement. Few, if any, studies exist that include an exercise component as well as measure emotional self-efficacy. Thus, it is difficult to determine whether the exercise component of this intervention was a factor in

the improvement. Several studies do exist, however, that show at least marginal increases on the Stanford Emotional Self-Efficacy Scale in response to some form of recreation or psychological therapy. This suggests that the recreation therapy component of the intervention may have been the primary influencing factor, including activities such as expressive arts or journaling, leisure counseling, relaxation training, and biofeedback. These activities may have helped the subjects to better express their emotions and confront their fears in a less threatening environment, thereby developing their confidence in sharing their feelings and reactions.

Although there is no existing research on exercise interventions and emotional self-efficacy, it is feasible that the exercise component of this study's intervention may have contributed to the improvements in emotional self-efficacy. Due to exercise training's ability to make one feel stronger and healthier, overall, exercise may help breast cancer survivors gain self-confidence that would make them more apt to open up to their personal feelings and emotions.

Limited literature exists that studies both emotional self-efficacy in breast cancer patients and some sort of intervention. A supportive-expressive group therapy program for women with metastatic breast cancer found an initial self-efficacy score of 74.63 pre-intervention. The group therapy allowed for emotional self-efficacy to be maintained over 12 months, as opposed to the control group, which suffered a decrease. The difference between the treatment and the control group was only marginally significant, however (Giese-Davis et al., 2002). The mean self-efficacy for the current study at baseline was 71.02, fairly similar to that found in the Giese-Davis et al. study. A study exploring traumatic stress symptoms among women with recently diagnosed breast cancer found a relationship between feelings

of intrusion and avoidance and emotional self-efficacy (Koopman et al., 2002), but did not report actual emotional self-efficacy values.

Quality of Life

While emotional self-efficacy has not been studied very extensively among cancer patients, a lot of work has been done on quality of life (QOL) in this population. With such a large group of cancer survivors currently living, the psychological well-being and physical functioning of this population is of considerable public health importance (Cadmus et al., 2009). Both exercise and psychotherapy studies have explored their impact on quality of life in breast cancer patients, with generally positive results. This study found a significant improvement in quality of life in a group of post-treated breast cancer patients who had participated in a combined exercise and recreation therapy intervention. Quality of life was assessed through the FACT-B questionnaire.

Previous studies have also found improvements in quality of life through several different types of interventions and against different parameters. Among a group of Western Australian breast cancer survivors, those that self-reported higher levels of physical activity also had higher quality of life scores on the FACT-B. Among those survivors that met the physical activity guidelines, the mean QOL score was 115.4. For those who did not meet the guidelines, the mean score was 106.9 (Milne et al., 2007). When comparing a group of recently diagnosed breast cancer patients and a group of post-treated breast cancer survivors, both of whom participated in a similar exercise intervention, responses on the FACT-B were very similar. Those subjects who had been recently diagnosed reported poorer physical and functional well-being, relative to the survivors, but better social and family well-being, as indicated on the various subscales of the FACT-B. Although the study states that the pre-

intervention QOL scores were relatively high, no total FACT-B score was reported which could be used as a comparison to the current study (Cadmus et al., 2009). In another study that was attempting to identify predictors of quality of life in breast cancer patients, the mean FACT-B score among one hundred and eleven patients was 89.89. This study indicated that education, income, job, and stage of disease were significantly associated with QOL. Mood, income, and fatigue were significant predictors of QOL (Suh, 2007).

An original study on the FACT-B studying its reliability and validity found an average FACT-B total score of 111.8 and 112.8 among a group of 47 and 295 breast cancer patients, respectively. Courneya and colleagues conducted a randomized controlled trial to determine if exercise could improve QOL in cancer survivors beyond the known benefits of psychotherapy. One group received only group psychotherapy while the second group received both group psychotherapy and a home-based exercise intervention. The results of the study suggest that a home-based, moderate intensity exercise program may improve QOL over group therapy alone in cancer survivors. Overall, the mean baseline QOL between the two groups was 118.4 and improved to 124.5 post-intervention for a 5% improvement (Courneya et al., 2003). Using a prospective longitudinal study observing the physical activity pattern of post-treated breast cancer patients and their mood, quality of life, and cancer-related symptoms, Pinto and colleagues found that exercise participation was associated with improved physical functioning, one of the subcategories of overall quality of life. The FACT-B scale was not used in Pinto's study and thus the results cannot be compared to the results of the current study (Pinto et al., 2002).

The current study found a 15% improvement in quality of life over the course of the six month intervention which is greater than is seen in some existing literature. This

improvement is most likely due to the combined intervention and the fact that this program is not a home-based program, but is one where survivors come to a facility with other survivors and are surrounded by supportive staff. The baseline QOL score of 105.75 was also lower than was seen in many other studies, which could also indicate that there was greater room for improvement among this group of breast cancer survivors. Quality of life is a crucial concept in this population because a higher quality of life may not only lead to a better health and disease outcome, but with a disease that is not always curable, the quality of the patient's survival may be as important as the length of the survival (Brady et al., 1996). Therefore, every effort should be made to promote a high quality of life among breast cancer patients and survivors and to tailor rehabilitation and intervention programs to best address quality of life levels.

For this reason, it is important to note that the great improvements found in this study most likely occurred as a result of the combined exercise and recreation therapy intervention. When comparing the results of this study to existing literature, it appears that the addition of a recreation therapy program had an additive effect to the exercise intervention, resulting in more significant changes across all parameters. Although these comparisons may be difficult to make due to the wide variety of assessment protocols and methodology, rehabilitation of both the body and mind may prove to be the key to improving quality of life in breast cancer survivors. Because the disease and the treatments of breast cancer impact both physiological and psychological functioning, a combination intervention may provide these patients with the best chance for making great improvements and consequently, improving their quality of life. It is necessary that future research include a randomized trial with different treatment groups (exercise only, recreation therapy only, combination group, and control group) in

order to gain a better understanding of the impact of a combined intervention on quality of life in this population.

What Physiological and/or Psychological Changes are the Main Contributors to Changes in Quality of Life in Post-Treated Breast Cancer Survivors?

Predicted VO_{2max} and fatigue were the only independent variables that accounted for a significant amount of the variance in overall quality of life among this group of post-treated breast cancer survivors, with predicted VO_{2max} being the largest contributor. Balance was the closest to being a contributor but was not statistically significant. It may, however, be clinically significant.

Although it was somewhat unexpected to have only predicted VO_{2max} and fatigue as contributing factors to quality of life, these two factors may be the ones that are most involved in daily living. Fatigue, as hypothesized, was one of the main contributors, most likely because it tends to be one of the more overwhelming symptoms of cancer and its treatments. If a patient does not have the energy to get out of bed, it does not matter how good their balance is or whether they are strong enough to lift a gallon of milk. Fatigue is a multidimensional symptom, with both physiological and psychological components. The fatigue experienced by cancer patients is therefore not only a physical tiredness, but a feeling that also may lead to mental distress, depression, and anxiety.

The areas of well-being that the FACT-B addresses are, in general, all areas that could be affected by fatigue. This would lead to it being a significant contributor to the overall outcome. The FACT-B includes sections on physical well-being, emotional well-being, social well-being, functional well-being, and relationship with one's doctor. An

overwhelming sense of fatigue, such as many cancer patients experience, could have an impact on each one of these subscale parameters.

Predicted VO_{2max} was the second contributing factor to QOL. VO_{2max} indicates one's cardiorespiratory fitness. Although separate from the previously discussed symptom of fatigue, a low level of cardiorespiratory fitness will lead to difficulty in completing activities of daily living and result in undue tiredness. Before the intervention, some of the subjects may have found it difficult to walk to their mailbox in order to check for mail. Inabilities such as this one would obviously affect the physical, functional, and potentially social well-being of these patients. Poor well-being in these areas may then cause a decrease in emotional well-being as the person becomes frustrated and anxious about the things that they can no longer do by themselves.

A combined exercise and recreation therapy intervention can provide the means for the changes that occurred in fatigue and predicted VO_{2max}, and then ultimately, the improvements in quality of life. The combined intervention addresses the whole person, not just the physical or mental components. Because the fatigue experienced by cancer patients and survivors is known to be a multidimensional symptom, the comprehensive approach that a combined intervention can provide may best address this symptom. The exercise portion of the program will help in addressing the physiological causes of fatigue, such as immune dysfunction, poor sleeping patterns, anemia, and poor physical conditioning. The recreation therapy may help to improve a patient's psychosocial situation, mood disorders, and can also help them find better ways of dealing with their pain.

The aerobic training component of an exercise intervention will improve a patient's predicted VO_{2max} through mechanisms discussed previously in this chapter. Several studies

have also shown improvements in predicted VO_{2max} through a recreation therapy or psychotherapy intervention (Dimeo et al., 2004). Although it is difficult to explain the physiology behind these improvements, the research does indicate such a trend. The recreation therapy component may have given the subjects the confidence and motivation to participate in a more active lifestyle on a daily basis, outside of the exercise sessions.

Overall, future interventions combining both exercise and recreation therapy should explore intervention designs that will maximize improvements in VO_{2max} while also imploring psychosocial interventions that can focus on reducing fatigue. Such an intervention may provide patients with an even greater chance of improving their overall quality of life and possibly a better chance at a successful treatment outcome.

Recommendations for Future Research

The following are recommendations for future experiments that will continue to explore the impact of exercise and recreation therapy in breast cancer survivors:

1. Increase the sample size. This study only had 19 subjects, which was a limitation of this study, as this number may have not produced enough statistical power to really draw any strong conclusions from this study.
2. Conduct a randomized trial with four treatment groups (exercise and recreation therapy, exercise only, recreation therapy only, and control). This design would test whether a combined intervention really provided any more significant benefits to patients then exercise or recreation therapy alone.
3. Break the subject pool into groups based on treatment(s) received, in order to best determine what intervention works on an individualized basis. Patients who have

received only surgery may respond differently than a patients who has had surgery and chemotherapy.

4. Classify subjects by the stage of breast cancer. Subjects with a more severe form of the disease may need more intensive interventions.
5. Include a healthy control group to determine if the responses would be the same in the breast cancer population.
6. Develop standard protocols for recreation therapy and exercise interventions so the study can be reproducible by other laboratories and implemented in hospitals and rehabilitation facilities.

Conclusion

As a result of this study, it was found that a combined exercise and recreation therapy intervention is an effective means of improving several physiological and psychological parameters in post-treated female breast cancer survivors. It was also observed that fatigue and predicted VO_{2max} are the greatest predictors of the variance in quality of life. Thus, future interventions aiming to improve quality of life in their patients should consider tailoring their programs to concentrate on improving these two factors in order to be the most efficient and effective. Future research needs to be conducted with larger sample sizes in order to determine the true value of a combined intervention. From the current research, however, it is evident that a combined exercise and recreation therapy intervention is a successful way to positively affect survivors' physical and mental well-being.

Appendix A: Revised Piper Fatigue Scale

GET REAL & HEEL!

Name: _____ Date: _____

Revised Piper Fatigue Scale

Directions: For each of the following questions, circle the number that best describes the fatigue you are experiencing now. Please make every effort to answer each question to the best of your ability. Thank you very much.

1. How long have you been feeling fatigued? (*check one response only*)
   a. Minutes_____
   b. Hours_____
   c. Days_____
   d. Weeks_____
   e. Months_____
   f. Other (*please describe*):_____

2. To what degree is the fatigue you are feeling now causing you distress?

No distress										**A great deal of distress**
0	1	2	3	4	5	6	7	8	9	10

3. To what degree is the fatigue you are feeling now interfering with your ability to complete work or school activities?

None									**A great deal**	
0	1	2	3	4	5	6	7	8	9	10

4. To what degree is the fatigue you are feeling now interfering with your ability to visit or socialize with your friends?

None									**A great deal**	
0	1	2	3	4	5	6	7	8	9	10

5. To what degree is the fatigue you are feeling now interfering with your ability to engage in sexual activity?

None									**A great deal**	
0	1	2	3	4	5	6	7	8	9	10

6. Overall how much is the fatigue, which you are experiencing now, interfering with your ability to engage in the kind of activities you enjoy doing?

None									**A great deal**	
0	1	2	3	4	5	6	7	8	9	10

7. How would you describe the degree of intensity or severity of the fatigue which you are experiencing now?

Mild									**Severe**	
0	1	2	3	4	5	6	7	8	9	10

To what degree would you describe the fatigue which you are experiencing now as being:

8. **Pleasant**	0	1	2	3	4	5	6	7	8	9 10 **Unpleasant**
9. **Agreeable**	0	1	2	3	4	5	6	7	8	9 10 **Disagreeable**
10. **Protective**	0	1	2	3	4	5	6	7	8	9 10 **Destructive**
11. **Positive**	0	1	2	3	4	5	6	7	8	9 10 **Negative**
12. **Normal**	0	1	2	3	4	5	6	7	8	9 10 **Abnormal**
13. To what degree are you now feeling: **Strong**	0	1	2	3	4	5	6	7	8	9 10 **Weak**
14. To what degree are you now feeling: **Awake**	0	1	2	3	4	5	6	7	8	9 10 **Sleepy**
15. To what degree are you now feeling: **Lively**	0	1	2	3	4	5	6	7	8	9 10 **Listless**
16. To what degree are you now feeling: **Refreshed**	0	1	2	3	4	5	6	7	8	9 10 **Tired**
17. To what degree are you now feeling: **Energetic**	0	1	2	3	4	5	6	7	8	9 10 **Unenergetic**
18. To what degree are you now feeling: **Patient**	0	1	2	3	4	5	6	7	8	9 10 **Impatient**
19. To what degree are you now feeling: **Relaxed**	0	1	2	3	4	5	6	7	8	9 10 **Tense**

20. To what degree are you now feeling:

Exhilarated **Depressed**

0 1 2 3 4 5 6 7 8 9 10

21. To what degree are you now feeling:

Able to concentrate **Unable to concentrate**

0 1 2 3 4 5 6 7 8 9 10

22. To what degree are you now feeling:

Able to remember **Unable to remember**

0 1 2 3 4 5 6 7 8 9 10

23. To what degree are you now feeling:

Able to think clearly **Unable to think clearly**

0 1 2 3 4 5 6 7 8 9 10

24. Overall, what do you believe is most directly contributing to or causing your fatigue?

_____

_____

25. Overall, the best thing you have found to relieve your fatigue is:_____

_____

26. Is there anything else you would like to add that would describe your fatigue better to us?_____

_____

27. Are you experiencing any other symptoms right now?

No

Yes Please describe:_____

_____

Revised Piper Fatigue Scale Calculations

Calculate each section separately. The answer should be between 0 and 10.
Add each of the total numbers and divide by 22 to get overall score of 0 to 10.

Missing Data
Follow this procedure if patient answered at least 75%-80% of the questions in each section.
1. add the values of the questions answered in that section
2. divide by the number of questions answered in that section
3. substitute that number for the missing number
4. calculate total score for that section by using the substituted number

Example:
#5 is commonly not answered

Behavioral/Severity	Score
#2 - distress	6
#3 - work/school	5
#4 - socialize	7
#5 - sex	____
#6 - activities	8
#7 - severity	5
Total	____ ÷ 6 = ____

Add 6+5+7+8+5 = 31 ÷ 5 = 6.2 Substitute 6.2 for #5

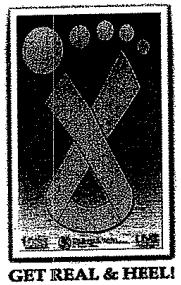
Behavioral/Severity	Score
#2 - distress	6
#3 - work/school	5
#4 - socialize	7
#5 - sex	6.2
#6 - activities	8
#7 - severity	5
Total	37.2 ÷ 6 = 6.2

Patient Name: _____

Revised Piper Fatigue Scale Calculations

Date: _____		Date: _____		Date: _____	
Behavioral/Severity	Score	Behavioral/Severity	Score	Behavioral/Severity	Score
#2 - distress----------	____	#2 - distress----------	____	#2 - distress----------	____
#3 - work/school------	____	#3 - work/school------	____	#3 - work/school------	____
#4 - socialize---------	____	#4 - socialize---------	____	#4 - socialize---------	____
#5 - sex---------------	____	#5 - sex---------------	____	#5 - sex---------------	____
#6 - activities--------	____	#6 - activities--------	____	#6 - activities--------	____
#7 - severity----------	____	#7 - severity----------	____	#7 - severity----------	____
Total	____ ÷ 6 = ____	Total	____ ÷ 6 = ____	Total	____ ÷ 6 = ____
Affective	Score	Affective	Score	Affective	Score
#8 - pleasant/un	____	#8 - pleasant/un	____	#8 - pleasant/un	____
#9 - agreeable/dis	____	#9 - agreeable/dis	____	#9 - agreeable/dis	____
#10 - protect/destr	____	#10 - protect/destr	____	#10 - protect/destr	____
#11 - positive/neg	____	#11 - positive/neg	____	#11 - positive/neg	____
#12 - normal/abn	____	#12 - normal/abn	____	#12 - normal/abn	____
Total	____ ÷ 5 = ____	Total	____ ÷ 5 = ____	Total	____ ÷ 5 = ____
Sensory	Score	Sensory	Score	Sensory	Score
#13 - strong/weak	____	#13 - strong/weak	____	#13 - strong/weak	____
#14 - awake/sleepy	____	#14 - awake/sleepy	____	#14 - awake/sleepy	____
#15 - lively/listless	____	#15 - lively/listless	____	#15 - lively/listless	____
#16 - fresh/tired	____	#16 - fresh/tired	____	#16 - fresh/tired	____
#17 - energy/un	____	#17 - energy/un	____	#17 - energy/un	____
Total	____ ÷ 5 = ____	Total	____ ÷ 5 = ____	Total	____ ÷ 5 = ____
Cognitive/Mood	Score	Cognitive/Mood	Score	Cognitive/Mood	Score
#18 - patient/imp	____	#18 - patient/imp	____	#18 - patient/imp	____
#19 - relax/tense	____	#19 - relax/tense	____	#19 - relax/tense	____
#20 - exhil/depr	____	#20 - exhil/depr	____	#20 - exhil/depr	____
#21 - concentr/not	____	#21 - concentr/not	____	#21 - concentr/not	____
#22 - memory/not	____	#22 - memory/not	____	#22 - memory/not	____
#23 - think/not	____	#23 - think/not	____	#23 - think/not	____
Total	____ ÷ 6 = ____	Total	____ ÷ 6 = ____	Total	____ ÷ 6 = ____
Total Score _____ ÷ 22 = _____		**Total Score** _____ ÷ 22 = _____		**Total Score** _____ ÷ 22 = _____	

Appendix B: Stanford Emotional Self-Efficacy Scale



GET REAL & HEEL!

Stanford Emotional Self-Efficacy Scale – Cancer

Please rate your confidence in your ability to do each of the following.

	Not at all confident										Completely confident
1. Let my friends know when I am angry because of something they did.	0	10	20	30	40	50	60	70	80	90	100
2. Directly consider the thought that I might die.	0	10	20	30	40	50	60	70	80	90	100
3. Be with people or do things without being distracted by painful emotions or anxious thoughts.	0	10	20	30	40	50	60	70	80	90	100
4. Ask for the emotional support I need from my spouse/partner or closest friend	0	10	20	30	40	50	60	70	80	90	100
5. Focus my full attention on one thing at a time.	0	10	20	30	40	50	60	70	80	90	100
6. Consider any issue at all while remaining calm and feeling centered.	0	10	20	30	40	50	60	70	80	90	100
7. Express love, affection, caring to my spouse/ partner or closest friend	0	10	20	30	40	50	60	70	80	90	100
8. Talk about my possible death with my spouse/ partner or closest friend	0	10	20	30	40	50	60	70	80	90	100
9. Talk to my doctor about fears that I have about dying.	0	10	20	30	40	50	60	70	80	90	100
10. Stay calm while waiting for the results of medical tests.	0	10	20	30	40	50	60	70	80	90	100

	Not at all confident										Completely confident
11. Face my fears about the thought that I might die without feeling anxious all day or all night.	0	10	20	30	40	50	60	70	80	90	100
12. Truly enjoy activities or people that are meaningful to me.	0	10	20	30	40	50	60	70	80	90	100
13. Express sadness or cry with family members	0	10	20	30	40	50	60	70	80	90	100
14. Cry or express other emotions I feel about dying when I am talking with someone close to me.	0	10	20	30	40	50	60	70	80	90	100
15. Ask for the emotional support I need from family members	0	10	20	30	40	50	60	70	80	90	100

Appendix C: Functional Assessment of Cancer Treatments-Breast

GET REAL & HEEL!

FACT-B (version 2)

Name: _____

Date: _____

	⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
	⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
	⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
	⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

Below is a list of statements that other people with your illness have said are important. By filling in one circle per line, please indicate how true each statement has been for you during the past 7 days.

During the past 7 days:	not at all	a little bit	some-what	quite a bit	very much
PHYSICAL WELL-BEING					
1. I have a lack of energy	⓪	①	②	③	④
2. I have nausea	⓪	①	②	③	④
3. I have trouble meeting the needs of my family	⓪	①	②	③	④
4. I have pain	⓪	①	②	③	④
5. I am bothered by side effects of treatment	⓪	①	②	③	④
6. In general, I feel sick	⓪	①	②	③	④
7. I am forced to spend time in bed	⓪	①	②	③	④

8. How much does your **PHYSICAL WELL-BEING** affect your quality of life?

Not at all ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so

During the past 7 days:	not at all	a little bit	some-what	quite a bit	very much
SOCIAL/FAMILY WELL-BEING					
9. I feel distant from my friends	⓪	①	②	③	④
10. I get emotional support from my family	⓪	①	②	③	④
11. I get support from my friends and neighbors	⓪	①	②	③	④
12. My family has accepted my illness	⓪	①	②	③	④
13. Family communication about my illness is poor	⓪	①	②	③	④
If you have a spouse/partner, or are sexually active, please answer # 14-15. Otherwise, go to # 16.					
14. I feel close to my partner (or main support)	⓪	①	②	③	④
15. I am satisfied with my sex life	⓪	①	②	③	④

16. How much does your **SOCIAL/FAMILY WELL-BEING** affect your quality of life?

Not at all ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so

During the past 7 days:	not at all	a little bit	some-what	quite a bit	very much
RELATIONSHIP WITH DOCTOR					
17. I have confidence in my doctor(s)	⓪	①	②	③	④
18. My doctor is available to answer my questions	⓪	①	②	③	④

19. How much does your **RELATIONSHIP WITH THE DOCTOR** affect your quality of life?

Not at all ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so

Please turn to the next page.

FACT-B (version 2)

During the past 7 days: **EMOTIONAL WELL-BEING**	not at all	a little bit	some-what	quite a bit	very much
20. I feel sad	⓪	①	②	③	④
21. I am proud of how I'm coping with my illness	⓪	①	②	③	④
22. I am losing hope in the fight against my illness	⓪	①	②	③	④
23. I feel nervous	⓪	①	②	③	④
24. I worry about dying	⓪	①	②	③	④

25. How much does your EMOTIONAL WELL-BEING affect your quality of life?

Not at all ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so

During the past 7 days: **FUNCTIONAL WELL-BEING**	not at all	a little bit	some-what	quite a bit	very much
26. I am able to work (include work in home)	⓪	①	②	③	④
27. My work (include work in home) is fulfilling	⓪	①	②	③	④
28. I am able to enjoy life "in the moment"	⓪	①	②	③	④
29. I have accepted my illness	⓪	①	②	③	④
30. I am sleeping well	⓪	①	②	③	④
31. I am enjoying my usual leisure pursuits	⓪	①	②	③	④
32. I am content with the quality of my life right now	⓪	①	②	③	④

33. How much does your FUNCTIONAL WELL-BEING affect your quality of life?

Not at all ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so

During the past 7 days: **ADDITIONAL CONCERNS**	not at all	a little bit	some-what	quite a bit	very much
34. I have been short of breath	⓪	①	②	③	④
35. I am self-conscious about the way I dress	⓪	①	②	③	④
36. My arms are swollen or tender	⓪	①	②	③	④
37. I feel sexually attractive	⓪	①	②	③	④
38. I have been bothered by hair loss	⓪	①	②	③	④
39. I worry about the risk of cancer in other family members	⓪	①	②	③	④
40. I worry about the effect of stress on my illness	⓪	①	②	③	④
41. I am bothered by a change in weight	⓪	①	②	③	④
42. I am able to feel like a woman	⓪	①	②	③	④

43. How much do these ADDITIONAL CONCERNS affect your quality of life?

Not at all ⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so

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