

The Relationship between Physical Activity Levels and Selected Physiological and
Psychological Parameters in Women with Breast Cancer Post Treatment

Sheila Marie Webster

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in
partial fulfillment of the requirements for the degree of Master of Arts in the Department
of Exercise and Sport Science (Exercise Physiology)

Chapel Hill
2007

Approved by:

Dr. Claudio Battaglini

Dr. Diane Groff

Dr. Edgar Shields

ABSTRACT

The Relationship between Physical Activity Levels and Selected Physiological and Psychological Parameters in Women Treated for Breast Cancer

Sheila M. Webster

(Under the direction of Dr. Claudio Battaglini)

Cancer treatments cause numerous side effects that can last years post-treatment. Fatigue is the most common side-effect and can lead to a reduction in patients' functionality and overall quality of life. The purpose of this study was to evaluate physical activity levels (IPAQ), selected physiological and psychological parameters on breast cancer survivors prior to starting an exercise/recreation therapy program. A secondary purpose explored relationships between the IPAQ and all psychological and physiological parameters evaluated. Sixteen female breast cancer patients participated in the study. Results found a significant positive relationship between physical activity levels and overall fatigue ($P=0.039$). A multiple regression analyses showed that depression accounted for the greatest amount of variance in both fatigue and quality of life ($P=0.012$ and 0.000). Knowing the multidimensional impact of cancer on overall fatigue and quality of life, the management of depression becomes critical in improving the patient's well being and overall health.

ACKNOWLEDGEMENT

I would like to take this opportunity to thank everyone who has helped me achieve this goal. It is only by you and the grace of God that I have been able to overcome this great task.

Kade Long
Larry and Dana Webster
Jim and Pam Long
Dr Claudio Battaglini

To everyone that has given me encouragement throughout the years, Thank You!

TABLE OF CONTENTS

LIST OF TABLES.....	vii
CHAPTERS	
I. INTRODUCTION.....	1
Statement of Purpose.....	4
Research Questions.....	4
Hypothesis.....	5
Definition of Terms.....	6
Assumptions.....	7
Delimitation.....	7
Limitations.....	8
Significance of Study.....	8
II. REVIEW OF LITERATURE.....	10
Breast Cancer Treatment-Related Side Effects.....	10
Physical Activity Levels and Breast Cancer.....	12
Aerobic Training and its Relationship to Alleviating Cancer Treatment-Related Side-Effects.....	15
Strength Training and its Relationship to Alleviating Cancer Treatment-Related Side-Effects.....	18
The Combination of Aerobic and Strength Training and their Relationship to Alleviating Cancer Treatment-Related Side-Effects.....	20

	Limitations of Research Involving Cancer and Exercise and The Combination of Exercise and other Therapies.....	22
III.	METHODOLOGY.....	26
	Subjects.....	26
	Including Criteria.....	26
	Excluding Criteria.....	27
	Recruitment Process.....	27
	Assessment Protocols.....	29
	Instrumentation.....	31
	Statistical Analysis.....	32
IV.	RESULTS.....	34
	Subjects.....	34
	Hypotheses One thru Six.....	35
	Hypothesis One.....	35
	Hypothesis Two.....	36
	Hypothesis Three.....	36
	Hypothesis Four.....	37
	Hypothesis Five.....	37
	Hypothesis Six.....	38
	Hypothesis Seven.....	38
	Hypothesis Eight.....	39
V.	DISCUSSION, CONCLUSION AND RECOMMENDATIONS.....	41
	Introduction.....	41
	Physical Activity Levels and Overall Fatigue.....	42

Physical Activity Levels and Overall Quality of Life.....	45
Cardiorespiratory Endurance on Selected Psychological Parameters.....	45
Overall Muscular Endurance on Selected Psychological Parameters.....	48
Overall Fatigue and Quality of Life: What parameters influence these two variables the most?.....	49
Research Questions.....	50
Conclusion.....	51
Recommendations.....	52
APPENDICES.....	54
Get REAL & HEEL Program Flier.....	54
Revised Piper Fatigue Scale.....	57
Center for Disease Control Depression Scale.....	63
Functional Assessment Cancer Treatment – Breast.....	65
International Physical Activity Questionnaire.....	68
Pre-Assessment Guidelines for Physiological Assessment.....	72
Resting Vitals Data Sheet.....	74
Modified Bruce Protocol.....	76
Overall Muscular Endurance Protocol.....	78
REFERENCES.....	81

LIST OF TABLES

Table

1. Timeline for Participant's Initial Visits.....	28
2. Subjects Characteristics.....	34
3. Descriptive Statistics Simple Regression Model.....	34
4. Relationship between Physical Activity Level and Fatigue Score.....	35
5. Relationship between Physical Activity Level and Overall Quality of Life.....	35
6. Relationship between VO_{2max} and Overall Fatigue Score.....	36
7. Relationship between VO_{2max} and Overall Quality of Life.....	36
8. Relationship between Overall Muscular Endurance and Overall Fatigue Score.....	37
9. Relationship between Overall Muscular Endurance and Overall Quality of Life.....	37
10. Descriptive Statistics of the Multiple Regression Analyses between Overall Fatigue Scores and OME, VO_{2max} , IPAQ, and CES-D.....	38
11. The Results of the Multiple Linear Regression between Overall Fatigue Scores and the Independent Variables IPAQ, VO_{2max} , OME, and CES-D.....	38
12. Descriptive Statistics of the Multiple Regression Analyses between Overall Quality of Life and OME, VO_{2max} , IPAQ, and CES-D.....	39
13. The Results of the Multiple Linear Regression between Overall Quality of Life Scores and the Independent Variables IPAQ, VO_{2max} , OME, and CES-D.....	39

Chapter I

Introduction

Today millions of people are living with cancer or have had it. Cancer begins when cells in the body begin to multiply and enlarge uncontrollably. It develops from damaged DNA that is either inherited or environmentally stimulated (American Cancer Society [ACS] 2006). Cancer is the second leading cause of death in the United States, however, medical advances and early detection have increased the number of individuals expected to survive (“Cancer Trends Progress Report,” 2005).

According to the American Cancer Society, 1 in 8 women are expected to be diagnosed with breast cancer sometime in their life. In 2006, it was estimated that 214,640 new cases of invasive breast cancer will be diagnosed in the United States (ACS, 2006). Approximately 2,369,036 are living with breast cancer in US right now (Surveillance, Epidemiology, and End Results Program [SEER], 2006). Breast cancer is defined as a malignant or benign tumor that has developed from cells of the breast. Although it is the second leading cause of cancer death in the US, mortality rates continue to decline (ACS, 2006). There is now a five-year survival rate for all women diagnosed with this cancer (Degate, 2006).

The four methods commonly used to treat breast cancer including surgery, chemotherapy, radiation, and hormone replacement. These treatments can be used separately or in combination with each other. There are, however, a multitude of side effects, physiological and psychological, that result from these treatments. Symptoms include but are

not limited to hot flashes, vaginal spotting, nausea, hair loss, vomiting, dyspnea, change in body composition, depression, tiredness, and overall fatigue (Degate, 2006). Fatigue is the most common side effect that affects between 72 and 95% of all cancer patients undergoing treatments (Jereczek-Fossa, Marsiglia, Orecchia, 2002). Fatigue is considered to be a multifactorial process and is not well understood (Dimeo, 2001). Many factors are believed to contribute to the development of fatigue experienced by breast cancer patients during and post-treatment. These factors include pain, electrolyte and fluid disturbances, anemia, impaired nutritional status, weight loss, change in concentration of metabolically active molecules as a result of the interaction between tumor and host defense, sleep disturbances, and overall body deconditioning due to a reduction in physical activity levels (Dimeo, 2001, Dimeo, Tilmann, Bertz, Kanz, Mertelsmann, Keul, 1997, Dimeo, Stieglitz, Novelli-Fischer, Fetscher, Kuel, 1999, Schwartz 1999, Jereczek-Fossa, Marsiglia, Orecchia, 2002, and Battaglini, Dennehy, Groff, Kirk, Anton 2006). The association between these factors is believed to contribute significantly to decrements in overall body functionality. The inability of performing simple daily tasks, usually caused by the compromised body functionality, can cause severe psychological and physiological distress, diminishing significantly the quality of life of cancer patients during and many years post treatment completion (Battaglini et al. 2006).

Recently studies have shown that exercise interventions may enhance the health and quality of life in those diagnosed with cancer (Dimeo et al. 1997, Dimeo et al. 1997, Dimeo et al. 1999, Rowland 2003). Exercise has been suggested to improve many physiological and psychological parameters affected by the cancer and cancer treatments, including significant reductions in the level of fatigue (Dimeo, 2001, Dimeo et al. 1998, Dimeo et al. 1999,

Courneya, Mackey, Bell, Jones, Fields, Fairey, 2003, Schwartz, 1999, Jereczek-Fossa et al. 2002). Improvements in overall mental and physical wellbeing can also lead to an increase in the feeling of independence and self-esteem, which could lead to better social interactions and a reduction of anxiety and fear (Dimeo et al. 1999). Even though exercise interventions have shown to assist breast cancer patients in the management of physical and psychological side-effects developed during the cancer experience, many questions regarding exercise interventions such as what is the most appropriate mode, frequency, and intensity of exercise for the breast cancer population is still not fully known. Furthermore, the association of exercise with other interventions such as recreational therapy, a therapy that focuses on overall well-being may maximize the benefits of exercise, has yet to be explored.

One area that has the potential to complement the physiological changes expected through exercise is recreation therapy. Recreation therapy techniques have been shown to improve psychological functioning as well as physical capabilities in patients undergoing cancer treatment (Shannon, 2005, and Shannon & Shaw, 2005). According to the Leisure and Well-Being Model, the five primary resources used in recreational therapy are psychological, cognitive, social, physical and environmental. Resources are defined as qualities, attributes, or contexts that have value and allow one to embrace life fully and that serve as protection in the faces of daily life events and adversity (Hood & Carruthers 2005). The key resources with regards to exercise and cancer are psychological, physical and environmental. Psychological resources deal with emotions such as positive mood, happiness, competency and sense of meaning. The physical resources are critical functions of exercise and include physical health and fitness, mobility and energy. Environmental resources encourage social connectedness and networking. Recreational therapy can consist

of several different activities. The main goal of recreational therapy is to find an activity that promotes a sense of enjoyment for the person and that will eventually improve their quality of life.

Therefore, the possibility of combining exercise and recreation therapy may provide breast cancer patients with the opportunity to rehabilitate more efficiently through a more comprehensive approach to combat the negative physiological and psychological changes commonly observed during the cancer experience. The Get REAL and HEEL Breast Cancer Program is an exercise/recreation therapy program designed to assist post-treated breast cancer patients in the management of side-effects commonly developed with cancer diagnosis and during cancer treatment. To the knowledge of the author, the combined effect of an individualized prescriptive exercise and recreation therapy program with the aim of improving psychological/ psycho-social, and physiological parameters in breast cancer patients has not been explored.

Statement of the Purpose

The reasons for this study are twofold. First, to evaluate physical activity levels and selected fitness and psychological parameters in breast cancer patients who enrolled in Get REAL & HEEL Breast Cancer program. Second, to explore the relationship between physical activity levels and selected fitness and psychological parameters on breast cancer patients who are within six months of completion of all major treatments.

Research Questions

All participants of this study were post-treated breast cancer patients measured prior to beginning the Get REAL and HEEL Breast Cancer Program.

1. Will physical activity levels be related to overall fatigue?

2. Will cardiorespiratory endurance (VO_{2max}) be related to overall fatigue?
3. Will Overall Muscular Endurance (OME) be related to overall fatigue?
4. Will Physical Activity Levels, VO_{2max} , OME, or Depression account for the greatest amount of variance on overall fatigue levels after controlling for the other variables.
5. Will physical activity levels be related to overall quality of life (QOL)?
6. Will VO_{2max} be related to QOL?
7. Will OME be related to QOL?
8. Will Physical Activity Levels, VO_{2max} , OME, or Depression account for the greatest amount of variance on QOL after controlling for the other variables.

Hypothesis

All participants of this study are post-treated breast cancer patients measured prior to beginning the Get REAL and HEEL Breast Cancer Program.

H1: There will be a significant inverse relationship between physical activity level and overall fatigue.

H2: There will be a significant inverse relationship between VO_{2max} and overall fatigue.

H3: There will be a significant inverse relationship between OME and overall fatigue.

H4: There will be a significant positive relationship between physical activity levels and overall quality of life.

H5: There will be a significant positive relationship between VO_{2max} and overall quality of life.

H6: There will be a significant positive relationship between OME and overall quality of life.

H7: Controlling for Physical Activity Levels, Depression and VO_{2max} , OME will explain the greatest amount of variance in fatigue.

H8: Controlling for Physical Activity Levels Depression, and VO_{2max} , OME will explain the greatest amount of variance on QOL.

Definition of Terms

Post Treated Breast Cancer Patients: Patients within six months of completion of all planned surgery, radiation therapy, and chemotherapy.

Get REAL & HEEL Breast Cancer Program: an exercise/recreation therapy program designed to assist post-treated breast cancer patients in the management of side-effects commonly developed with cancer diagnosis and during cancer treatment.

Resting Heart Rate (RHR): Number of contractions of the heart per minute. Normal resting values: 70 beats per minute (bpm)

Resting Blood Pressure (RBP): The pressure exerted by blood on the walls of the blood vessels. Usually measured in the systemic arteries. Normal resting values: <120/<80 mmHg.

Resting Hemoglobin Saturation (RHS): Amount of oxygen bound to hemoglobin at any given partial pressure of oxygen (PO_2) as a percentage. Normal resting values: 98% at alveolar and arterial PO_2 (100 mmHg)

Overall Fatigue: Overwhelming sustained sense of exhaustion and decreased capacity for physical and mental work at the usual level.

Overall Quality of Life: Overall enjoyment of life, physiological and psychological, which includes a person's sense of well-being and ability to do the things that are important to them (Cella, 1994).

VO_{2max}: The maximum amount of ventilatory oxygen extraction during exercise estimated from the ACSM guidelines equation (Appendix VIII)

Overall muscular endurance (OME): The summation of the results of the muscular endurance tests (total number of repetitions) for the abdominal crunches (regular), push-up, biceps curls, and leg extension exercises.

HHR (Heart Rate Reserve) Method: Also known as the Karvonen method.

$$[(220 - \text{age}) - \text{RHR}] \times \text{intensity (\%)} + \text{RHR}$$

Physical Activity Level: The amount physical activity performed in the past week based on intensity, duration and frequency of the event.

Assumptions

- All patients enrolled in the study strictly followed the pre-testing guidelines prior to reporting for testing.
- The impact of different cancer treatments and drugs resulted in similar side effects experienced by the patients enrolled in the study.
- Subjects honestly and accurately answered the questionnaires that will be used to assess fatigue and QOL.
- 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

- 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.

- All subjects have been diagnosed with breast cancer and had completed cancer treatment within six months.
- All subjects have received permission from their oncology physician prior to enroll in the Get REAL & HEEL Breast Cancer Program.

Limitations

- The small sample size decreased significantly the power of the statistical analyses (N=16)
- The sub-maximal test used for the assessment of VO_2 may present some measurement error since some subjects may have never used a treadmill before and may feel uncomfortable performing the test.

Significance of the Study

Lately complementary therapies have been given much more exposure as a way to manage cancer and cancer treatments. Exercise has been shown to have a positive impact on patients throughout their cancer experience. However, because previous research has used such a variety of different intensities, modes and protocols, it is difficult to determine in what way exercise has really benefited this population as an intervention. Also, the possibility of a combined approach in the management of cancer treatment-related side-effects using exercise and recreation therapy, with the goal of maximizing the possible physiological and psychological benefits of exercise, has yet to be reported in the literature. To the knowledge of this author, no other cancer program in the country offers the possibility for breast cancer patients to participate in an individualized prescriptive combined exercise/recreation intervention. Therefore, understanding some important physiological and psychological relationships prior to starting the

administration of this innovative combined therapy will assist in the evaluation of the program through the creation of means for future comparisons. The results of this study will then be used in a follow-up study that will be conducted six months post exercise/recreation therapy intervention with the goal of evaluating the efficiency of this combined therapies program designed for post-treated breast cancer patients.

Chapter II

Review of Literature

For the purpose of organization, this review of literature was organized into six sections: breast cancer treatment related-side effects, physical activity levels and breast cancer, aerobic training and its relationship to alleviating cancer treatment-related side-effects, strength training and its relationship to alleviating cancer treatment-related side-effects, the combination of aerobic and strength training and their relationship to alleviating cancer treatment-related side-effects, and limitations of research involving cancer and exercise and the combination of exercise and other therapies.

Breast Cancer Treatment-Related Side Effects

There are several treatment options for breast cancer including surgery, chemotherapy, radiation therapy and hormone therapy. These treatments can be used independently or in a combination with each other depending on the patient and complexity of the disease. Although these treatments have increased survival rate, they can also have serious side effects that can last not only during the treatment but years later. Of all the psychological and physiological side effects, the most common is fatigue affecting 72-90% of all cancer patients which could limit the ability to perform simple daily tasks (Jereczek-Fossa, Marsiglia, Orecchia, 2002). The inability to perform simple daily tasks, can cause significant psychological and physiological distress diminishing significantly the quality of

life of cancer patients during and many years post treatment completion (Battaglini et al. 2006).

Bowers, Ganz, Desmond, Rowland, Meyerowitz and Belin (2000) proposed a study to observe the occurrence of fatigue in breast cancer survivors. Two sample groups ($n=1,957$) were asked to complete a health survey, symptoms checklist, depression, and sleep questionnaires to determine their level of fatigue. This sample of breast cancer survivors were then compared to age matched women in the general population and women at risk for cancer. Results showed that breast cancer survivors reported slightly higher levels of energy compared to women in the general population ($P=0.009$) but lower levels than the women at risk for cancer ($P=0.0001$). There were also significant relationships between energy and fatigue ($P=0.0001$). Those women who were more fatigued had lower quality of life.

Another study by Ganz, Coscarelli, Fred, Kahn, Polinsky, and Petersen (1996) examined the quality of life and psychosocial concerns of breast cancer patients 1, 2, and 3 years post treatment. The 139 participants that were interviewed during the first year after treatment also completed mail surveys at 2 and 3 years post treatment. The standardized instruments used evaluated quality of life, rehabilitation needs, and psychological distress as well as post-surgical recovery, employment and insurance problems, social support, and existential concerns. A randomized sample of these survivors was then asked to participate in an in-person interview to expand upon the questionnaires. Scores of the Profile of Moods State and Functional Living Index-Cancer were the same for both 2 and 3 years post treatment and did not differ from the 1-year assessment. The Cancer Rehabilitation Evaluation System scores show a significant decline in quality of life, sexual functioning and marital functioning between the first and third year years ($p=0.0004$, 0.0001 and 0.0016

respectively). The participants had a higher level of social and role functioning as well as general health and a decrease in pain compared to patients with chronic medical conditions. The results also show that there were frequent problems associated with physical and recreational activities, body image, sexual interest and function, and problems with dating, for those who were single, that persisted beyond the first year post-treatment.

Physical Activity Levels and Breast Cancer

Research shows that after breast cancer, physical activity levels decrease possibly due to the increased level of fatigue. The following articles, however, show that physical activity is beneficial in decreasing the risk of adverse cancer related outcomes and possible increasing survivorship.

Holmes, Chen, Feskanich, Kroenke, and Colditz (2005) performed an observational study on 2987 female registered nurses diagnosed with stage I, II, or III breast cancer between 1984 and 1998. The study continued to monitor these females every two years until 2002 or death whichever came first. The questionnaire assessed the amount and level of physical activity performed weekly during the past year. The metabolic equivalent task (MET) scores were then classified using Ainsworth's Compendium of Physical Activities (1993). Results show that any category of activity over three MET hours per week was associated with a decreased risk of an adverse breast cancer outcome ($P < 0.05$). Also those who engaged in physical activities equal to walking an hour or more a week had a better survival rate than those who did not.

A study by Irwin, McTiernan, Bernstein, Gilliland, Baumgartner, Baumgartner, and Biallard-Barbash (2004) observed 806 women diagnosed with stage 0-IIA breast cancer who were participating in the Health, Eating, Activity and Lifestyle Study. The study involved an

in-person interview assessing physical activity levels up to three years post treatment. Results showed that 32% of breast cancer survivors met the recommended 150 min/wk of moderate to vigorous intensity sport/recreational physical activity. Fewer obese breast cancer survivors met the recommendation compared to overweight and lean breast cancer survivors ($P < 0.05$).

In another study, Blanchard, Baker, Denniston, Courneya, Hann, Gesmen, Reding, Flynn, and Kennedy (2003) examined the amount of physical activity and change in physical activity since cancer diagnosis to determine which affects quality of life more. Three hundred fifty-two adult cancer survivors were recruited to complete a self-report questionnaire. The questions focused on the amount of exercise the person participates in and the change in the amount of exercise since the diagnosis. The participants were also required to complete a quality of life questionnaire as well. Results show that those who exercised three times a week had significantly higher quality of life scores than those who do not exercise. Also those who maintained or increased the amount of exercise since diagnosis have a significantly higher quality of life than those who exercised less than before ($P < 0.01$). After comparing the results of absolute amount of exercise and change in the amount of exercise after diagnosis, the change in exercise since diagnosis had a higher correlation to quality of life ($\Delta R^2_{\text{adjusted}} = 0.01$ and 0.07 respectively).

Pinto et al. (2002) developed a longitudinal prospective study on the levels of physical activity in breast cancer patients. The study followed 69 women with early stages of breast cancer and examined the trends of exercise participation over the first year following cancer diagnosis and treatment. Participants were asked to complete various questionnaires assessing mood, quality of life cancer related symptoms, and exercise behavior at baseline and every three months for a year. Results showed an increase in mean minutes of moderate

intensity exercise over the 12 months (65.4 min at baseline to 103.2 minutes at 12 months). Almost half reported an intention to increase exercise at each assessment (51.6%). Exercise participation did not predict overall mood disturbance or predictive global distress. Exercising at recommended levels of moderate intensity exercise and vigorous intensity exercise were positive predictors of overall quality of life ($p=0.004$ and $p=0.0001$ respectively).

Battaglini et al. (2004) performed a study to determine if there was a relationship between physical activity and fatigue levels in cancer patients post treatment. Twenty-seven cancer patients participated in a variety of psychological and physiological assessments before and six months post intervention. Results show a positive correlation between fatigue levels and the following independent variables: improvements in resting cardiac frequency, abdominal exercise, leg press exercise and reduction in percent body fat. The results, although encouraging, were not statistically significant.

Because physical activity levels tend to be lower after treatment, a study was designed to assess the exercise preferences of cancer survivors. 307 people diagnosed with prostate, breast, colorectal or lung cancers were recruited to participate in Jones and Courneya's (2002). The study used self-administered surveys containing questions on demographics, medical variables, past exercise and exercise counseling and preferences. According to the results 84% would prefer to receive exercise counseling during their cancer experience. Ninety eight percent would like their exercise program to be recreational activities with a majority preferring moderate intensity over high intensity activities (57%). Also 32% would like to start their exercise program before treatment.

Rogers, Matevey, Hopkins-Price, Shah, Dunnington, and Courneya (2004) followed up Jones and Courneya (2002) with a study that explored the social cognitive theory to promote exercise in breast cancer patients. Twelve breast cancer patients were recruited to participate in one of three focus group sessions. The focus groups used the social cognitive theory to explore the knowledge, attitudes, and behaviors breast cancer patients have about physical activity. Each session was audio recorded to be coded later for statistical analysis. Results show that half the participants exercised regularly in the past and one third currently exercise regularly. Half the patients believed that exercise would be beneficial during treatment while the other half felt that it might impede success of the treatment or have a negative effect. The most common obstacle for not exercising was fatigue followed by lack of time, cost and location. Also most participants were not aware of the exercise recommendations for cancer patients after diagnosis. The most enjoyable type of exercise was walking followed by yoga.

Aerobic Training and its Relationship to Alleviating Cancer Treatment-Related Side-Effects

Since the 1990s, experts have explored how aerobic training could reduce cancer treatment related side effects.

In 1998 Dimeo et al. proposed a study to determine if an exercise program could improve physical performance in cancer patients suffering from fatigue. Five cancer patients suffering from fatigue were selected for a six-week aerobic training study. The training program consisted of walking on a treadmill five days a week for six weeks. Intensity was based on lactate concentrations (3 ± 0.5 mmol/L) that coincided with a heart rate of $80 \pm 5\%$ of their maximum during the stress test. Duration increased from three minutes five times a day during the first week to 30-35 minutes continuously in the sixth week. Results show that

training distance and maximal performance (MET) increased significantly while heart rate and lactate concentrations were significantly lower ($P < 0.05$).

Schwartz (1999) designed a home-based study to explore the relationship between exercise, fatigue and quality of life. The study enrolled 27 subjects with breast cancer, who were beginning chemotherapy, to complete an eight week home based exercise program. The aerobic activity was based on the participants' preference and was scheduled for 15-30 minutes 3-4 days a week. Baseline and posttest measures included a functional ability test and various psychological questionnaires. Results show a significant difference in functional ability between those who adopted the exercise program and those who didn't ($p = 0.002$). There was a decline in overall quality of life in nearly all subjects; however, there was less of a decline in those who improved in functional ability. Fatigue increased during the trial peaking after the third dose of chemotherapy. Those who exercised were able to maintain or lose weight during chemotherapy while those who didn't exercise gained weight ($p = 0.03$). With these findings it can be suggested that there may be an optimal intensity of exercise to reduce fatigue however if the intensity is too high exercise may provoke fatigue during cancer treatments.

In 2003, Pinto, Clark, Maruyama, and Feder examined the changes in distress, body image and fitness following an exercise program in women diagnosed with breast cancer within the past three years. The study randomly selected 24 sedentary women into either a 12 week moderate intensity exercise program or a wait-list control group. The supervised exercise program consisted of an aerobic activity three days a week progressing from 10 minute to 30 minutes a session with an intensity of up to 60-70% of their peak heart rate. Participants were instructed to use at least three modes of activity per session. To assess

changes each participant completed a peak graded exercise stress test and several questionnaires to determine distress and body imaging. Results showed a significant decrease in blood pressures and heart rate ($p < 0.05$) as evidence of fitness improvements. There was a decrease in the Anger, Depression, Confusion, Tension, Fatigue, and Total Mood Disturbance scales in both the exercise and control groups. However there was an increase in Vitality scores only in the exercise group. None of these results were statistically significant. There was no significant change in weight in the exercise group however, the Body Esteem scales were significantly higher in the exercise group than in the control group ($p = 0.03$).

A study by Courneya, Mackey, Bell, Jones, Field, (2003) evaluated the effects of an aerobic exercise program on cardiopulmonary function and quality of life in postmenopausal breast cancer survivors. Fifty-two participants were randomly assigned to an exercise program or a control group for 15 weeks. Data was measured by a graded exercise test and a quality of life questionnaire. The exercise intervention was a supervised aerobic program three times a week increasing to up to 35 minutes each session on a recumbent or upright cycle ergometer. The training intensity corresponded to 70-75% maximal oxygen consumption in untrained subjects. Results show an increase in peak oxygen consumption in the exercise group and a decrease in the control group (+0.24L/min and -0.05L/min respectively). Quality of life also increased by 9.1 points in the exercise group and only 0.3 in the control group. Statistics showed a change in peak oxygen consumption is correlated with change in quality of life ($P < 0.01$).

A study by Thorsen et al. (2005) evaluated the effectiveness of a supervised home based exercise program on cardiorespiratory fitness, mental distress and health related quality of life in cancer patients after chemotherapy. The 111 cancer patients were divided into a

control group and an exercise group that lasted 14 weeks. Baseline and post-exercise measurements were assessed for cardiorespiratory fitness and quality of life. The exercise program could be any type of activity twice a week for at least 30 minutes each session however more sessions with longer durations were allowed. The control group was instructed to be physically active but did not receive supervised training. Results showed an increase in VO_{2max} in both the control group and exercise group (10% and 23% respectively). There was also a decrease in the fatigue score of the European Organisation for Research and Treatment of Cancer Core Quality of Life Questionnaire C30 scores in both groups however the control group had a greater decrease than the exercise group (17 points and 5.8 points respectively). There was also a decrease in mental distress in both groups at the end of the trial period.

Sixteen breast cancer survivors participated in a study by Herrero et al. (2006) to investigate the effects that cardiorespiratory fitness has on quality of life in previously untrained breast cancer survivors. Each participant was asked to complete a quality of life questionnaire and a graded exercise test on a cycle ergometer. Results show a significant inverse relationship between quality of life scores and age, body mass, percent heart rate peak at ventilatory threshold and peak ventilation at ventilatory threshold ($p < 0.05$). A significant positive relationship ($p < 0.05$) was found for quality of life and peak power output, peak heart rate, and respiratory compensation thresholds.

Strength Training and its Relationship to Alleviating Cancer Treatment-Related Side-Effects

Recently, strength training has been considered a way to alleviate cancer treatment related side effects. There are very few studies that investigate how strength training alone can improve selected physiological and psychological side effects, however.

In 2005 Schmitz et al. designed a randomized control trial to assess the safety and efficacy of a twice a week resistance training program in recent breast cancer survivors. The 81 participants were divided into an immediate and delayed treatment groups. The immediate group would train from month 0 –12 and the delayed group would do no activity for the first six months and then begin a resistance training program for months 7-12. Body weight, height, body fat, lean mass, body fat percentage, waist circumference, fasting glucose, insulin, insulin resistance and insulin like growth factor axis proteins will be measured at baseline, month 6 and month 12. During the first three months of the trial, all participants were supervised and taught safe and effective resistance training techniques. After the first three months the participants were encourage to continue on their own with nine common exercises using machines and free weights. Participants were instructed to lift 8-10 repetition and increase to three sets for each exercise. Results show a significant increase in lean mass ($P<0.01$) as well as a significant decrease in percent body fat ($p=0.03$). There were no significant differences between the treatment groups. There was also a significant decrease in IGF-II levels in the immediate group post treatment. A concluding remark from the author stated that a twice-weekly resistance training program was found to be safe and effective in breast cancer survivors.

A similar study by Ohira et al., (2006) was designed to determine if resistance training could change quality of life scores and depressive symptoms in breast cancer survivors. The randomized control study measured 86 breast cancer survivors with an overall quality of life and depression evaluation before and after the resistance training intervention. The weight training intervention was supervised for the first three months and unsupervised for the last three months or the study. The participants were taught nine basic resistance

training exercises and stretching techniques and were required to keep an exercise log of their progress. Results show that there was a 91.9% participant retention by the end of the intervention. Physical and psychosocial scores of the QOL assessment significantly improved ($P<0.05$) with the treatment by 2.1% and 2.5% respectively compared to the control group (-1.2% and 0.3%). There was no relationship between resistance training and depression scores in either group. Correlation statistics showed that changes in bench press were significantly correlated to physical and psychosocial global scores ($P<0.01$). Changes in total lean mass were also correlated to changes in physical and psychosocial global scores ($P<0.05$), however changes in leg lean mass and leg press were not.

The Combination of Aerobic and Strength Training and their Relationship to Alleviating Cancer Treatment-Related Side-Effects

Since past research has shown that aerobic training and strength training can alleviate cancer treatment related side effects independently, more studies have started to incorporate the training programs together to determine if the combination will produce even more benefits. The limitation to several of these studies however is the small sample size.

Singh et al., (2006) developed a study to assess the safety and effectiveness of an eight-week full body aerobic and resistance-training program on 27 breast cancer survivors. Physical fitness levels and quality of life measurements were obtained at baseline and after the eight-week intervention. Lymphedema was also monitored throughout the trial. Subjects performed two resistance training session and three aerobic sessions for eight weeks. The first two weeks were supervised as were weeks five and eight to ensure proper technique. Resistance training consisted of 10 exercises at 8-12 RM with a 72 hour break between sessions. The aerobic session was self selected with at target heart rate zone of 65-85% max heart rate. Each subject was responsible for recording their own data in a training log

provided to them. Results show there was a significant decrease in sum of five skinfolds ($P < 0.05$) while body weight was unchanged. Maximal aerobic power (VO_{2max}) increased significantly as well as upper body and lower body strength and endurance ($P < 0.05$). There was also a significant increase in shoulder flexibility ($P < 0.05$). All quality of life scores increased with training however only the psychological domain had a significant increase ($P < 0.01$). Overall quality of life and general health results were also significantly improved with training ($P < 0.05$). Also no lymphedema was observed throughout the trial.

In 2006, Herrero et al. studied the effects of detraining on the functional capacity of previously trained breast cancer survivors. The 11 breast cancer survivors were to perform a series of tests to determine their aerobic capacity, muscular strength and endurance, body composition, functionality, and overall quality of life. These tests were run before and after a combined exercise program of eight weeks and then again after the detraining period of eight weeks. Results showed that training induced improvements in muscular strength and endurance. Functional capacity and quality of life were not significantly changed after detraining ($P < 0.05$). However cardiorespiratory capacity and total muscle mass decreased significantly from post training to detraining ($P < 0.01$). A concluding remark from the authors stated that cancer survivors who have participated in a combined exercise program can retain some training gains, such as improvements in quality of life and muscular strength and endurance and functional performance, after a short detraining period.

In 2004, Hayes et al proposed a study to investigate the changes in quality of life in 12 patients receiving peripheral blood stem cell transplantation. The phases were categorized into PI, before PBST; PII, during PBST; and PIII, three months after PBST. The third phase was divided into a control group and an exercise group that participated in a moderate

intensity mixed type physical fitness program for 12 weeks. Data were obtained using a quality of life questionnaire and a maximal graded exercise test during each phase. Results show that there was a significant decline in quality of life in those undergoing PBST ($P < 0.05$). The exercising patients improved their quality of life when compared to pretransplant ratings and the non-exercising patients ($P < 0.01$ and 0.05 respectively). Quality of life was also correlated to peak aerobic capacity ($P < 0.05$).

Instead of focusing on a full body exercise intervention, McKenzie et al. (2003) concentrated on the upper body exercises for eight-week in breast cancer survivors with lymphedema. Fourteen participants were randomly assigned to a treatment or a control group. The intervention included six upper body resistance exercises progressing to two sets of ten repetitions three days a week with stretching as well as an upper body aerobic training program using an arm cycle ergometer progressing to twenty minutes with a resistance of 25W. Results showed no significant difference in arm circumference in either group. An increase in physical functioning, general health and vitality, although not significant, was found in the exercise group.

Limitations of Research Involving Cancer and Exercise and the Combination of Exercise and other Therapies

An area that has the potential to alleviate cancer treatment related side effects but has had very few studies done is recreational therapy. Recreation therapy is a broad area that includes all types of leisure activities such as art therapy, yoga, tai chi chuan, and massage therapy.

Hernandez-Reif et al., (2004) studied the effects of massage therapy on mood, stress and immune systems. Thirty-four breast cancer survivors were randomly assigned to a

massage therapy group or a control group. The massage was received thirty minutes three times a week for five weeks. On the first and last day of the study each participant was assessed on the immediate impact the treatment had on anxiety, depression, anger and vigor and the long-term effects the treatment had on depression, anxiety, hostility, and body image. A urinalysis was also taken to measure certain hormones. The results showed that there was an immediate change in anxiety, depression, mood, and anger and a long-term effect in depression and hostility. There was also an increase in urinary dopamine, serotonin NK cell numbers and lymphocytes. These results conclude that women with stage 1 and 2 breast cancer may benefit from massage therapy as a way to alleviate cancer treatment related side effects.

Since activity levels tend to decrease after treatment, a qualitative study by Shannon, (2005) looked at ways to assist breast cancer patients in minimizing the negative impacts on their leisure time while improving their quality of life throughout treatment. The study collected data on 8 women through an in-depth interview and a focus group. The first interview asked questions designed to get an insight into each person's breast cancer experience and their limitations and challenges they've experienced throughout treatment. The interview was audio recorded and analyzed to identify patterns and themes for each participant. After the data was analyzed the women were invited to participate in a focus group to hear the interview interpretations and provide feedback to confirm that the analysis was appropriate. From analyzing the interviews, three themes were developed: constraints to leisure, mitigating psychological effects, and lack of emphasis on the role of leisure. Constraints to leisure dealt with the physical limitations after surgery and the lack of energy during treatments as well as the guilt of doing "leisure activities" instead of fulfilling family

and occupational roles. The psychological effects that were most commonly described were fear, anxiety and anger. The last theme that was addressed was the lack of emphasis that was placed on leisure activities by their doctors and other healthcare professionals. This study showed the importance of incorporating leisure activity into normal daily living during and after breast cancer treatments.

To determine what type of leisure activities are important to breast cancer survivors, Shannon and Shaw, (2005) proposed a study to understand the changes in leisure activity choices after breast cancer treatment. Eight breast cancer survivors were again recruited to participate in the study. Similar to the previous study by Shannon (2005), there was an in-depth interview followed by a focus group. The interviews discovered three main themes within each participant: making leisure a priority, the desire for meaningful leisure, and focusing on health-promoting leisure behaviors. The women developed a greater appreciation of time after the breast cancer diagnosis and had decided to make leisure a priority. They also become more thoughtful in the type of leisure activity that they engaged in. The last theme was to be more conscious in choosing a leisure activity that helps promote healthy behaviors.

There are numerous studies that focus on breast cancer patients and exercise. Since the 1980s researchers have investigated aerobic training, strength training and the combination of the two training methods as ways to alleviate cancer and cancer treatment related side effects. Recreational therapy has also been shown to improve psychosocial aspects in cancer patients however very few research studies have been published. The idea of combining an exercise intervention with recreational therapy is a novel approach to mitigating side effects commonly seen in cancer patients. The Get REAL & HEEL Breast Cancer program is the only study to date that has designed such a program. Therefore the

significance of this study is to understand the relationships between physiological and psychological parameters with the goal of evaluating the efficacy of the Get REAL & HEEL Breast Cancer Program.

Chapter III

Methodology

The reasons for this study are twofold. First, to evaluate physical activity levels and selected fitness and psychological parameters in breast cancer patients who enrolled in Get REAL & HEEL Breast Cancer program. Second, to explore the relationship between physical activity and selected fitness and psychological parameters.

Subjects

Volunteers for this study consisted of 16 females, ages 30 to 75 years old with a confirmed diagnosis of stage I, II or III invasive breast cancer. Volunteers were within six months of completing scheduled surgery, radiation and/or chemotherapy. All participants were recruited from the 13 counties of the N.C. Affiliate of the Susan G. Komen Foundation, through physician's referral and oncology practices and hospitals.

Including Criteria

- Confirmed diagnosis of stage I, II, III invasive breast cancer
- Within six months of completion of all planned surgery, radiation therapy and chemotherapy
- Ages ranging from 30 to 75 years
- Patients receiving adjuvant hormonal therapy or adjuvant trastuzumab were also eligible

Exclusion Criteria

Because of the potential risks involved in exercise, patients were screened for exclusion based upon the following criteria:

- 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
- Adequate renal function with creatinine < 1.5 mg/dL
- Immune deficiency that would compromise the patient's ability to participate in the program;
 - Absolute Neutrophil Count (ANC) < 1.5 μ L
 - Platelet (Plt) < 90 GL (900,000 mm³)
 - Hematocrit (Hct) < 30%
- Metastatic disease

Recruitment Process

Oncology physicians and nurses were given an informational flier with information about the Get REAL & HEEL Breast Cancer Program (Appendix I). Potential participants were then introduced to the program by the physician or nurse and were given information on how to participate. The Get REAL & HEEL Breast Cancer Program contact information was located on the advertisement flier provided to physicians and nurses. The participant then contacted the directors of the program or the program coordinator to schedule a visit to the program facilities. Once the patients have expressed interest in the study, a packet of

psychological and physiological questionnaires was mailed out to them to be completed prior to the first visit. During the first visit, participants received further information about the program, were screened for eligibility, and given a tour of the facilities. If eligibility for participation was confirmed, the participant completed the Physical Activity Readiness Questionnaire. Three psychological assessments (Appendices II, III, and IV respectively) and physical activity assessment (Appendix V) were evaluated by the Get REAL & HEEL staff. An informed consent approved by the UNC Biomedical IRB and a Health Insurance Portability and Accountability Act of 1996 (HIPPA) authorization for use and disclosure of health information for research purposes forms were also given to eligible participants to be read at home and were signed until the next visit, where further questions about the program were answered prior to signing the forms. During the second visit, after questions of the program were answered and the informed consent and HIPPA forms signed, an assessment of physiological parameters were scheduled and pre-assessments guidelines were given to each participant with explanations on how to prepare for the battery of physiological assessments (Appendix IV). During the third visit, resting vitals were taken (Appendix VII), followed by the physiological assessments.

The assessment of physiological parameters included a sub-maximal cardiorespiratory endurance treadmill test (the Modified Bruce Protocol) (Appendix VIII) to estimate VO_{2max} , and a sub-maximal overall muscular endurance protocol (Appendix IX). The exercises that were used for the assessment of Overall Muscular Endurance (OME) test included: abdominal crunches (regular), push-up, biceps curls, and leg extension exercises, all developed at the Rocky Mountain Cancer Rehabilitation Institute. Table 1 shows the timeline for the events:

Table 1. Timeline for Participant's Initial Visits

Visit 1	Visit 2	Visit 3
More information about Get REAL and HEEL program	Answer any questions that may arise	Take resting vitals
Screen participant for eligibility	Sign the Informed Consent and HIPPA	Perform cardiovascular endurance protocol
Give tour of facilities	Give participant pre-assessment guidelines for next time	Perform muscular endurance protocols
Have participant complete Physical Activity Readiness Questionnaire	Schedule next visit for physiological evaluation	
Evaluate FACT-B, Revised Piper Fatigue Scale Depression scale and IPAQ		
Give the participant an Informed Consent and HIPPA form to look over at home		

Assessment Protocols

Each patient recruited for the study were asked to answer three psychological instruments including the Revised Piper Fatigue Scale (RPFS), the Functional Assessment of Cancer Therapy-Breast (Fact- B), and the Center for Epidemiologic Studies Depression Scale (CES-D) and a questionnaire for the assessment of physical activity levels, the International Physical Activity levels (IPAQ).

The Revised Piper Fatigue Scale is a self-administered questionnaire consisting of 22 questions in 4 subscales: behavioral/severity, affective meaning, sensory, and cognitive/mood. It has been shown to be an effective measurement for assessing fatigue in breast cancer patients (Piper, Dibble, Dodd, Weiss, Slaughter, Paul 1998). Scores for the

Revised Piper Fatigue Scale range from 0-10 with 0 being no fatigue and 10 being the greatest amount of fatigue possible.

The Functional Assessment of Cancer Therapy-Breast is another 44 item self-reported instrument designed to measure the multidimensional quality of life in breast cancer patients. The FACT-B is an appropriate tool for both clinical trials and practices (Brady, Cella, Mo, Bonomi, Tulsky, Lloyd, Deasy, Cobleigh, Shiimoto 1997). The FACT-B scores can range from 0-148 with the higher the score the greater the overall quality of life.

The Internal Physical Activity Questionnaire was developed to monitor the amount of physical activity and inactivity internationally. There are several forms of the IPAQ. The one used for this study is the self-administered short form. The short form of the IPAQ is scored based on the amount of physical activity performed within the past week. The amount of physical activity is then divided into three categories: low (1), moderate (2), and highly (3) physically active. The IPAQ has been accepted as a way to measure physical activity levels among adults in diverse settings (Craig, Marshall, Sjostrom, Bauman, Booth, Ainsworth, Pratt, Edlund, Yngve, Sallis, Oja 2003).

The Center for Epidemiological Studies questionnaire for depression is a twenty item questionnaire, commonly used to measure depressive symptoms in cancer patients. According to Hann, Winter and Jacobson (1999), the CES-D is a valid and reliable measure of depressive symptomatology in breast cancer patients. Scores for the CES-D range from 0-60 with 0 being no depressive symptoms and 60 being the greatest amount of depression one can experience.

The modified Bruce protocol is a sub-maximal treadmill test that is used in many high-risk patients because it imposes less stress to the patients than the traditional Bruce

protocol. In this protocol speed is not increased right away while grade begins at 0% and increases by 5% during the first two stages. After the third stage the protocol is similar to the regular Bruce protocol. Target heart rate for this test is determined using the Heart Rate Reserve method with an intensity of 75% for test termination.

The Overall Muscular Endurance Test is a combination of endurance protocols developed at the Rocky Mountain Cancer Rehabilitation Institute. The participant perform a battery of endurance exercises continuing with them until they 1) break cadence or form, 2) report a rating of perceived exertion of 7/10 or 3) stop on their own. The sum of these exercise repetitions will then be considered their overall muscular endurance. The exercises include abdominal crunches (regular), push-ups, biceps curls, and leg extensions.

Instrumentation

Changes in psychological parameters were evaluated using questionnaires listed above. The program directors and co-investigators administered each questionnaire.

To measure resting vitals, the patient were asked to remain seated for approximately five minutes with a Polar Heart Rate monitor (Lake Success, NY) in place. During that time the lowest heart rate observed was recorded. Blood pressure was assessed following the heart rate measurement using a Diagnostix 700 aneroid sphygmomanometers (Hauppauge, NY) and Litmann stethoscope (St Paul, MN). Hemoglobin saturation was measured using a Sport Stat finger pulse oxymeter (Plymouth, MN). Following the vitals, height and weight were obtained using a balance beam physician scale equipped with height rod (Health o meter 402KL Rye, NY).

Cardiovascular endurance was assessed using the modified treadmill Bruce protocol (Quinton Fitness Equipment Bothell, WA). Heart rate was again assessed using the Polar Heart Rate Monitor.

Overall muscular endurance was assessed using a modified version of the sub-maximal protocol designed at the Rocky Mountain Cancer Rehabilitation Institute. The exercises that were used for these tests were the bicep curls, leg extensions (Magnum Fitness Retro Series Machine 3001, South Milwaukee, WI), the standardized push up and a partial curl-up.

Statistical Analyses

All data was gathered and entered into an electronic database for analysis. Descriptive statistics were presented in the form of means and standard deviations. All data were analyzed on SPSS version 14.0 for Windows, a statistical software program. Hypotheses 1-6 were tested using a simple linear regression, while 7 and 8 were tested using a multiple linear regression. All participants of this study were post-treated breast cancer patients measured prior to beginning the Get REAL & HEEL Breast Cancer Program.

H1: There will be a significant inverse relationship between physical activity level and overall fatigue. The variables included in the analyses were the results obtained from the administration of the IPAQ questionnaire and the Revised Piper Fatigue Scale.

H2: There will be a significant inverse relationship between VO_{2max} and overall fatigue. The variables included in the analyses were the results obtained from the cardio-respiratory endurance test and the RPFS questionnaire.

H3: There will be a significant inverse relationship between OME and overall fatigue. The variables included in the analyses were the results obtained from the overall muscular endurance test and the RPFS questionnaire.

H4: There will be a significant positive relationship between physical activity levels and overall quality of life. The variables included in the analyses were the results obtained from the administration of the IPAQ questionnaire and FACT-B questionnaire.

H5: There will be a significant positive relationship between VO_{2max} and overall quality of life. The variables that included in the analyses were the results obtained from the cardio-respiratory endurance test and the FACT-B questionnaire.

H6: There will be a significant positive relationship between OME and overall quality of life. The variables that were included in the analyses were the results obtained from the overall muscular endurance test and the FACT-B questionnaire.

H7: OME will have the greatest predictor of variance in overall fatigue. The variables included in the analyses were the results obtained from the OME, VO_{2max} , IPAQ, CES-D and Revised Piper Fatigue Scale.

H8: OME will have the greatest predictor of variance on overall quality of life. The variables included in the analyses were the results obtained from the OME, VO_{2max} , IPAQ, CES-D and the FACT-B questionnaire.

CHAPTER IV

RESULTS

All data were entered into an electronic database for analysis. All data were analyzed on SPSS version 14.0 for Windows, a statistical software program. An alpha level of 0.05 was used for all statistical procedures. A Missing Value Imputation procedure was used to replace a missing value of one subject's depression score (CES-D) and another subject's physical activity level score (IPAQ) for all analyses that included these two variables. The values replaced were estimated by a mean computation of the non-missing values of these two variables. Descriptive statistics are presented in the form of means and standard deviations.

Subjects

Subjects in this study were 16 female patients, ranging in age from 30 to 75 ($\bar{x}=53.4$) post-treated for breast cancer. Subjects were recruited from the 13 counties of the N.C. Affiliate of the Susan G. Komen Foundation, through physician's referral and oncology practices and hospitals. Characteristics are presented in Table 2 below.

Table 2. Subjects Characteristics

	Age (years)		Body Weight (kilogram)		Height (centimeters)		Body Composition (% Body Fat)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Post Treated Breast Cancer Patients n=16	53.44	9.59	77.03	18.06	161.61	4.97	30.60	4.81

Hypotheses One to Six

Hypotheses 1 - 6, were analyzed using a simple linear regression model and included the following variables: Overall Fatigue (RPFS), Overall Quality of Life (QOL), International Physical Activity Questionnaire (IPAQ), Overall Muscular Endurance (OME), and Cardiorespiratory Endurance (VO_{2max}). Scatterplots were examined for each simple regression model and were found to be linear. The descriptive statistics for the variables in the simple linear regression model analyses (n=16) are presented below in Table 3.

Table 3 Descriptive Statistics Simple Regression Model

Variable	Mean	SD
Physical Activity Level (IPAQ)	1.47	0.74
Overall Fatigue (Revised Piper Fatigue Scale)	5.14	1.97
Overall Quality of Life (FACT-B)	101.59	19.65
VO_{2max} (Modified Bruce Protocol)	24.4	1.75
OME (Summation of the number of repetitions of all muscular endurance tests)	50.72	22.17

Hypothesis One

There will be a significant inverse relationship between physical activity level and overall fatigue. Variables obtained from the administration of the IPAQ questionnaire (independent) and the Revised Piper Fatigue Scale (dependent) were included in the simple linear regression analysis. A significant inverse relationship was found between physical activity level and overall fatigue scores ($r(15) = -0.521$, $p = 0.039$). The results of the analysis of hypothesis one are presented below in Table 4.

Table 4. Relationship between Physical Activity Level and Overall Fatigue Score

Physical Activity Level (IPAQ)	Overall Fatigue Scores (Revised Piper Fatigue Scale)	
	R ²	0.271
	Slope	-1.429
	P value	0.039
n = 16		

Hypothesis Two

There will be a significant positive relationship between physical activity levels and overall quality of life. Variables included in the simple linear regression model were the results obtained from the administration of the IPAQ questionnaire (independent) and FACT-B questionnaire (dependent). No significant relationship was found between physical activity level and overall quality of life ($r(15) = 0.140$, $p = 0.605$). The results of the analysis of hypothesis two are presented below in Table 5.

Table 5. Relationship between Physical Activity Level and Overall Quality of Life

Physical Activity Level (IPAQ)	Overall Quality of Life (FACT-B)	
	R ²	0.020
	Slope	3.831
	P value	0.605
n = 16		

Hypothesis Three

There will be a significant inverse relationship between cardiorespiratory endurance and overall fatigue. Variables included in the simple linear regression model were obtained from the cardio-respiratory endurance test (independent) and the Revised Piper Fatigue Scale (dependent). No significant relationship was found between cardiorespiratory endurance and overall fatigue scores ($r(15) = 0.299$, $p = 0.261$). The results of the analysis of hypothesis three are presented below in Table 6.

Table 6. Relationship between VO_{2max} and Overall Fatigue Score

		Overall Fatigue Scores (Revised Piper Fatigue Scale)
VO _{2max} (Modified Bruce Protocol)	R ²	0.089
	Slope	0.337
	P value	0.261
n = 16		

Hypothesis Four

There will be a significant positive relationship between cardiorespiratory endurance and overall quality of life. Included in the simple regression model were the results obtained from the cardio-respiratory endurance test (independent) and the FACT-B questionnaire (dependent). No significant relationship was found between cardiorespiratory endurance and overall quality of life ($r(15) = -.361$, $p = 0.170$). The results of the analysis of hypothesis four are presented below in Table 7.

Table 7. Relationship between VO_{2max} and Overall Quality of Life

		Overall Quality of Life (FACT-B)
VO _{2max} (Modified Bruce Protocol)	R ²	0.130
	Slope	-4.062
	P value	0.170
n = 16		

Hypothesis Five

There will be a significant inverse relationship between overall muscular endurance (OME) and overall fatigue. Variables included in the simple regression model were the results obtained from the overall muscular endurance test (independent) and the Revised Piper Fatigue Scale (dependent). No significant relationship was found between OME and overall fatigue scores ($r(15) = -0.270$, $p = 0.311$). The results of the analysis of hypothesis five are presented below in Table 8.

Table 8. Relationship between Overall Muscular Endurance and Overall Fatigue Score

Overall Muscular Endurance (OME)	Fatigue Scores (Piper Fatigue Scale)	
	R ²	0.073
	Slope	-0.024
	P value	0.311

n = 16

Hypothesis Six

There will be a significant inverse relationship between overall muscular endurance (OME) and overall quality of life. Variables included in the simple regression model were the results obtained from the overall muscular endurance test (independent) and the FACT-B questionnaire (dependent). No significant relationship was found between OME and overall quality of life ($r(15) = 0.006$, $p = 0.984$). The results of the analysis of hypothesis six are presented below in Table 9.

Table 9. Relationship between Overall Muscular Endurance and Overall Quality of Life

Overall Muscular Endurance (OME)	Overall Quality of Life (FACT-B)	
	R ²	0.000
	Slope	0.005
	P value	0.984

n = 16

Hypothesis Seven

OME will be the greatest predictor of variance in overall fatigue levels after controlling for all other variables. Variables included in the multiple linear regression model were the results of IPAQ, VO_{2max} , OME, and CES-D scores (independent) and the score from the Revised Piper Fatigue Scale (dependent). The descriptive statistics of the multiple linear regression analyses are presented below in Table 1.

Table 10. Descriptive Statistics of the Multiple Regression Analyses between Overall Fatigue Scores and OME, VO_{2max}, IPAQ, and CES-D

Variables	Mean	Std. Deviation	N
RPFS	5.14	1.97	16
IPAQ	1.47	.72	16
VO _{2max}	24.40	1.75	16
OME	50.72	22.17	16
CES-D	15.60	11.37	16

The multiple linear regression, using a stepwise procedure was calculated to predict subjects fatigue score based on their IPAQ, VO_{2max}, OME, and CES-D scores. The result of the linear regression analyses is presented below in Table 11

Table 11. The Results of the Multiple Linear Regression between Overall Fatigue Scores and the Independent Variables IPAQ, VO_{2max}, OME, and CES-D

Model	R	R ²	Adjusted R ²	Standard Error of the Estimate	df	F	Significance
1	0.612	0.375	0.330	1.613	1,14	8.404	0.012

Predictor: CES-D

After analyzing the data using the multiple linear regression equation with a stepwise procedure, the only independent variable that accounted for a significant amount of variance in overall fatigue scores was depression. This variable accounted for approximately 37% of the change in overall fatigue scores in post-treated breast cancer patients.

Hypothesis Eight

OME will have the greatest predictor of variance on quality of life after controlling for all other variables. The variables included in the multiple regression model included the results of OME, VO_{2max}, IPAQ, and FACT-B. The results of the multiple regression analysis are presented below in Table 12.

Table 12. Descriptive Statistics of the Multiple Regression Analyses between Overall Quality of Life and OME, VO_{2max}, IPAQ, and CES-D

Variables	Mean	Std. Deviation	N
FACT B	101.59	19.65	16
IPAQ	1.47	0.72	16
VO _{2max}	24.40	1.75	16
OME	50.72	22.17	16
CES-D	15.59	11.37	16

The multiple linear regression, using a stepwise procedure was calculated to predict subjects overall quality of life score based on their IPAQ, VO_{2max}, OME and CES-D scores.

The result of the linear regression analyses is presented in Table 13.

Table 13. The Results of the Multiple Linear Regression between Overall Quality of Life Scores and the Independent Variables IPAQ, VO_{2max}, OME, and CES-D

Model	R	R ²	Adjusted R ²	Standard Error of the Estimate	df	F	Significance
1	0.810	0.656	0.631	11.927	1,14	26.698	0.000

Predictor: CES-D

After analyzing the data using the multiple linear regression equation with a stepwise procedure, the only independent variable that accounted for a significant amount of variance in overall quality of life scores was depression. This variable accounted for approximately 65% of the change in overall quality of life scores in post-treated breast cancer patients.

CHAPTER V

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

Introduction

Previous research has shown that physical activity can improve quality of life scores in breast cancer patients post-treatment and also decrease the risk of an adverse breast cancer outcome (Blanchard et al. 2003, Holmes et al. 2005, Irwin et al. 2004, and Pinto et al. 2002). Irwin et al reported that only 32% of breast cancer survivors meet the American College of Sports Medicine recommended amount of 150 minutes of physical activity a week. However, in a study conducted by Jones and Courneya (2002), 84% of cancer patients enrolled in the study reported that they would like to be more informed of their options for exercising after cancer diagnosis.

Even though exercise has been shown to effectively lessen some of the physiological and psychological changes resulting from cancer diagnosis and treatments, many of the psychological changes can only be addressed to a certain extent. Specific evaluation of psychosocial parameters prior to engaging in regular physical activity and its relationship with physical fitness is of important concern. This understanding may help researchers in the development of more integrated interventions targeting the body in a more holistic way. The concept of using an intervention aimed at strengthening the cancer patients, both mentally and physically, may prove to be more beneficial than an intervention that uses exercise or a psychosocial therapy individually. Therefore, a better understanding of the physical and

psychological state of patients and the relationship between physiological and psychological variables prior to engaging in a regular exercise intervention combined with recreational therapy is necessary. The study of psychological and physiological parameters through reliable and valid measures and the impact the relationships have between these parameters, is of fundamental importance not only in evaluating the combined intervention, but also to define more specific recommendations for the development of more efficient programs aiming at assisting breast cancer patients to cope with the disease and its treatment. With a better understanding of this new idea of combining exercise and recreation therapy interventions together, quality of life and ultimately survivorship may be improved beyond what is currently accomplished through exercise and psychosocial interventions administered independently. Therefore, the purpose for this study was twofold. First, to evaluate physical activity levels and selected fitness and psychological parameters in breast cancer patients who enrolled in Get REAL & HEEL Breast Cancer program. Second, to explore the relationship between physical activity and selected fitness and psychological parameters.

Physical Activity Levels and Overall Fatigue

Hypothesis one assessed the relationship between physical activity level (IPAQ) and overall fatigue scores (RPFS). Results showed a significant inverse relationship between the dependent variable RPFS and independent variable IPAQ ($p = 0.039$), meaning that as physical activity levels move up from a category of low to moderate or moderate to high, overall fatigue scores will decrease by approximately 14%. Although no studies have evaluated physical activity levels before an exercise intervention, a study conducted by Battaglini et al. (2004) was the first one attempting to understand these relationships. The study was to determine if there was a relationship between different fitness components and

fatigue levels in twenty-seven patients post-treatment for various types of cancer at the end of a six months exercise program. The fitness components included in Battaglini et al. study design were percent body fat, resting heart rate, total time on a treadmill test, three different resistance exercises; chest press, leg press, abdominal, and flexibility (modified sit and reach). No significant relationships were found ($P=.351$) between any of the fitness components and fatigue levels, six months post exercise intervention, but a positive relationship and a possibility of a trend was observed. In Battaglini et al.'s study, the authors addressed the non significant findings to the small and non homogeneous sample used in the study. However, the authors suggested that the trend observed was very informative. According to the authors, significant changes in fatigue levels over time could be attained with a larger and more homogeneous sample but the combination of all variables included in a regression model would be necessary for a change in fatigue to occur instead of analyzing each fitness component independently. This also agrees with Dimeo et al.'s (1998) idea that fatigue is believed to be a multifactorial process impacted by many different physiological and psychological changes that occur with cancer and cancer treatment.

With the results presented in this current study, the more physically active a breast cancer patient is post treatment, the less likely the patient will experience fatigue to the same extent as a less physically active patient. The result of hypothesis one is somewhat similar to studies where breast cancer patients that exercised during major treatment regimens (Dimeo et al. 1997, Dimeo et al. 1997, Dimeo, Steiglitz, Novelli-Fischer, Fetscher, and Keul 1999, and Schwartz et al. 2000) experienced fewer treatment related side-effects including fatigue. Based on current literature involving cancer and exercise, the increase in physical activity levels that will be promoted during participation on the Get REAL & HEEL Breast Cancer

program, should allow participants to experience a reduction in fatigue levels. The question then becomes; will a combined therapy of exercise and recreation therapy either have the same or a more profound impact on fatigue reductions when compared to previous studies where exercise or psychosocial therapies were used independently? By using recreational therapies that assist in the development of skills to cope with stressors of the disease post-treatment, it is plausible to expect better results from this combined intervention. The improvements in physiological parameters associated with reductions on fatigue levels can be attained by improving the cardiovascular system through aerobic training and the development of muscular strength and endurance affected during cancer treatment through resistance and flexibility training. Improvements in the cardiovascular system can include increases in the production of red blood cells, which could lead to more oxygen being delivered to active muscles faster potentially causing an increase in time to physical fatigue. An improvement in muscular strength and endurance could allow the patient to perform normal daily activities they may have not been able to do before the exercise intervention such as carrying and putting away groceries or even playing with their children for longer periods of time. Because patients who undergo surgery as a treatment for breast cancer tend to lose the mobility in the affected shoulder, an exercise program that incorporates flexibility can also have a great impact on fatigue levels and overall quality of life. With the addition of a psychosocial therapy designed to improve physiological changes that occur after cancer diagnosis, on a traditional exercise intervention for breast cancer patients post treatment, it is expected that there will be significant improvements in the patients, functionality, fatigue levels and overall quality of life.

Physical Activity Levels and Overall Quality of Life

Hypothesis two looked at the relationship between physical activity levels and overall quality of life. Results showed no significant relationship between physical activity level and quality of life ($r=0.157$, $p=0.577$). However, Blanchard et al. (2003) and Pinto et al.'s (2002) observational studies found that those breast cancer patients that exercised regularly had a higher quality of life score than those who did not exercise.

The finding of the current study could be caused by a variety of reasons such as the very low levels of physical activity reported by the participants prior to beginning the Get REAL & HEEL Program or psychological reasons such as fear of death, changes in body composition, alterations of their lifestyle or decreases in their overall physical functions due to treatments. Therefore, physical activity may be only one aspect of the variety of factors that contributes to overall quality of life. The Get REAL & HEEL program has been designed to address these different needs multidimensionally, using the Leisure and Well-being Model. The Leisure and Well-being model incorporates five different resources, including physical, social, cognitive, psychological, and environmental, to find an activity that promotes a sense of enjoyment for the person and that will eventually improve the person's overall quality of life.

Cardiorespiratory Endurance and Selected Psychological Parameters

Hypothesis three looked for a relationship between cardiorespiratory endurance (VO_{2max}) and overall fatigue scores, however, no significant relationship was found between VO_{2max} and overall fatigue scores ($r=0.299$, $p=0.261$). Schwartz (1999) found an increase in fatigue with increased cardiorespiratory endurance, while Dimeo et al (1998) who found a decrease in fatigue with improved performance. The contradictory results of these two

studies cited above may be explained by the different exercise protocols used, different intensity, frequency, and duration of each exercise design, and maybe the environment in which these patients were studied.

Schwartz's study was an unsupervised aerobic training intervention on breast cancer patients undergoing chemotherapy for eight weeks. The program suggested that the participants exercised aerobically 15-30 minutes a session for 3-4 times a week. Although there were follow up phone calls, the participants were trusted to log their activities accurately throughout the trial. Based on the results, there was an increase in cardiorespiratory fitness but an increase in fatigue. Fatigue was the highest in both groups after the third dose of chemotherapy but the exercise group had a higher level of fatigue than the control group.

Dimeo et al.'s study was a supervised exercise program on cancer patients experiencing fatigue. The program was an aerobic training program consisting of walking on a treadmill five days a week for six weeks. The intensity of the sessions corresponded to a lactate concentration of 3 ± 0.5 mmol/L. The study found that with aerobic exercise, patients were able to exercise for a longer duration at a higher intensity with less fatigue than the control group. Although this study only looked at fatigue only as a physical side effect, the results were still encouraging.

The discrepancy between Dimeo and Schwartz's studies can also be explained by the difference between the administration of the exercise (home based non-supervised vs. in-hospital supervised) social connection or lack thereof, encouragement, accuracy in reporting participation in the training program and understanding the questionnaires used in the study to evaluate fatigue.

The results found in the current study, supports the idea that fatigue cannot be looked as a unifactorial process. According to Dimeo et al., 1999, fatigue is a process where multiple systems compromised by the diagnosis and treatment of cancer, impact the physiological and psychological functioning of the patient. By looking at only one physiological parameter, in this case VO_{2max} , it was expected that a relationship would not be significant, especially since the VO_{2max} mean analyzed in this current study was quite low ($\bar{x}=24.4$ ml/kg/min). Based on previous studies, it is possible however, that with the administration of the combined intervention proposed by the Get REAL & HEEL program, an improvement in VO_{2max} could be related to overall fatigue. Although possible, it's more likely that this relationship may still not be significant and a combination of changes in psychological and physiological systems will be needed for a significant decrease in overall fatigue scores.

Hypothesis four looked at cardiorespiratory endurance (VO_{2max}) and overall quality of life. Again no significant relationship was found between VO_{2max} and overall quality of life ($r= -.361$, $p= 0.170$). The reason for the non-significant results could be from a low number of participants, which can lower the statistical power of the data. A larger sample size may assist in finding more significant relationships between the variables. Several past studies have found that with improved cardiorespiratory endurance there was an increase in overall quality of life (Pinto et al. 2003, Courneya et al 2003, Thorsen et al. 2005, Herrero et al. 2006) Work by Singh et al. (2006) and Herrero et al. (2006) also found significant improvements in quality of life and VO_{2max} with their combined aerobics training with resistance training interventions.

None of the studies looked at relationships between cardiorespiratory endurance and overall quality of life prior to beginning the intervention but did find that once the study was

complete there were an improvements as well as a positive relationship between both variables. Based on previous research, it is expected that patients enrolled in the Get REAL & HEEL program will also experience improvements in VO_{2max} . This improvement could then lead to a significant relationship with overall quality of life. Because high overall quality of life scores may not be reliant of cardiorespiratory endurance alone, the Get REAL & HEEL program has been design to target all fitness components including cardiorespiratory endurance, muscular strength and endurance and flexibility, as well as psychological changes necessary to bring about the increases.

Overall Muscular Endurance and Selected Physiological Parameters

Hypothesis five evaluated the relationship between overall muscular endurance and overall fatigue scores while hypothesis six looked at OME and overall quality of life. No significant relationship was found for either hypothesis five or six ($r = -0.270$, $p = 0.311$ and $r = 0.006$, $p = 0.984$ respectively). Again the small sample size may have an influence on the non-significant finding in this study. If there were more participants there would be an increase in statistical power for the analysis. There are few studies that have assessed quality of life and fatigue levels on resistance training interventions.

Segal, Reid, Courneya, Malone, Parliament, Scott, Venner, Quinney, Jones, Slovinec D'Angelo, Wells (2003) conducted an intervention in 155 prostate cancer patient undergoing androgen deprivation therapy to determine if resistance training could improve quality of life scores and decrease overall fatigue as well. The 12-week study found an improvement in quality of life and fatigue scores in the exercise group. There were also significant increases in both lower body and upper body strength but no significant changes in body composition.

Ohira et al. (2006) assessed resistance training and quality of life scores in a six-month semi-supervised intervention. Results show improvements in muscular strength and body composition as well as a significant positive relationship between lean muscle mass and quality life scores.

The non-significant finding in the current study again supports the idea that fatigue cannot be looked as a unifactorial process. The findings could also be due to the small sample size as well. However, based on the current finding and previous research it is expected that patients enrolled in the Get REAL & HEEL program will experience improvement in muscular strength and endurance with the intervention which may contribute to the improvements in overall quality of life and fatigue scores.

Overall Fatigue and Quality of Life: What parameters influence these two variables the most?

When determining the independent variables that would be included in the multiple regression model, depression scores were added to the current variables of cardiorespiratory endurance, overall muscular endurance scores, and physical activity levels since it is a side effect commonly seen in cancer patients with high overall fatigue scores and a low quality of life. Depression was not analyzed using a simple regression equation in this study for either fatigue or quality of life based on the high correlations found in previous research.

Hypotheses seven and eight used multiple linear regression models to determine which independent variable accounts for the greatest amount of variance in the dependent variables overall fatigue and quality of life. The expectations of the author were that overall muscular endurance would account for the greatest amount of variance in both fatigue and overall quality of life. This was based on previous research that improving muscular endurance allows cancer patients the ability to perform tasks needed for normal daily living thus

alleviating physical fatigue and improving their overall quality of life. However, based on the results of the multiple linear regression analyses, depression accounted for the greatest amount of variance in both overall fatigue and quality of life. The correlation between depression and fatigue was somewhat high ($r = 0.612$) so it would be plausible to consider that depression would account for the greatest amount of variance in fatigue scores (approximately 37%). The correlation scores for depression and overall quality of life were even greater ($r = -0.810$) explaining 65% of the variance. Therefore it is expected that if depression scores can be lowered during the Get REAL & HEEL program through the combined intervention of exercise and recreational therapy, there will be a decrease in overall fatigue and increase in overall quality of life scores.

Research Questions

1. Will physical activity levels be related to overall fatigue?

Physical activity levels can predict overall fatigue scores in post-treated breast cancer patients.

2. Will cardiorespiratory endurance (VO_{2max}) be related to overall fatigue?

No relationship was found between cardiorespiratory endurance and overall fatigue.

3. Will Overall Muscular Endurance (OME) be related to overall fatigue?

No relationship was found between overall muscular endurance and overall fatigue.

4. Will physical activity levels be related to overall quality of life (QOL)?

No relationship was found between physical activity levels and overall quality of life.

5. Will cardiorespiratory endurance (VO_{2max}) be related to QOL?

No relationship was found between cardiorespiratory endurance and overall quality of life.

6. Will OME be related to QOL?

No relationship was found between overall muscular endurance and overall quality of life.

7. Will Physical Activity Levels, VO_{2max} , OME, or Depression account for the greatest amount of variance on overall fatigue levels after controlling for the other variables.

Controlling for all other variables, depression scores accounted for the greatest amount of variance on overall fatigue scores.

8. Will Physical Activity Levels, VO_{2max} , OME, or Depression account for the greatest amount of variance on QOL after controlling for the other variables.

Controlling for all other variables, depression scores accounted for the greatest amount of variance on overall quality of life scores.

Conclusion

According to the results of the study, a significant inverse relationship between physical activity levels and overall fatigue scores was expected. According to previous studies, increase in physical activity levels in cancer patients reduces overall fatigue levels. Since fatigue is believed to be multifactorial due to many physiological and psychological changes that occurs after the cancer diagnosis and treatment, it is possible to believe that a more significant reduction in fatigue can be attained by not only increasing physical activity levels but using psychological techniques in combination with exercise. Therefore, the Get REAL & HEEL program may give a whole new perspective on managing cancer and treatment related sides effects that could prove to be more efficient than programs that uses exercise as the only intervention.

The non-significant findings between fitness components and overall fatigue and quality of life, suggests that the Get REAL & HEEL Program, designed to address not only fatigue but also other symptoms developed during the cancer experience through a multidimensional approach, may be beneficial in improving overall fatigue scores, quality of life, and possibly overall treatment outcome and survivorship.

According to the results of this study, depression accounted for the greatest amount of variance in fatigue and overall quality of life. Knowing the multidimensional impact of cancer on overall fatigue and quality of life, the management of depression becomes critical in improving the patient's well being. The use of exercise has been shown in previous literature to improve depression. However, a program that combines exercise and specific recreation therapy techniques designs to relieve psychological stress, including depression, may provide even better results.

In conclusion, the results of this study will assist the Get REAL & HEEL program evaluating the efficacy of this novel combined intervention approach. Based on previous research this new technique has the potential to enhance the benefits attributed so far to exercise and psychosocial therapies currently administered independently.

Recommendations

According to the results of this study, the following are recommendations for continued research in the area of cancer and exercise, specifically research that addresses issues related to physical activity levels, overall fatigue, and overall quality of life in post treated breast cancer patients.

1. Larger sample size to increase statistical power

2. Different assessment protocols should be explored to maximize the accuracy of the data collected. A questionnaire that focused more on physical subscales may be needed for understanding the all the components that make up cancer fatigue and overall quality of life.
3. Distribute psychological questionnaires to all patients prior to initial consultation to prevent any bias results. This problem was resolved immediately but two of the participants did not complete their psychological and International Physical Activity questionnaires prior to their initial visit which could have lead to a more positive outlook thus skewing their data.
4. Bring in participants for a familiarization session of physiological assessment prior to testing since there may be some patients who have never performed these types of activities before.
5. The study should be an experimental design using pre-post test to give the results more credibility.

Appendix I

Get REAL & HEEL Program Flier

Get REAL & HEEL Breast Cancer Program

Program Description

The Department of Exercise and Sport Science (EXSS) at the University of North Carolina at Chapel Hill (UNC-CH) and the Lineberger Comprehensive Cancer Center have worked collaboratively to develop a unique program designed to serve breast cancer patients who live in North Carolina. The purpose of "Get-REAL & HEEL" (Get Recreation –Get Exercise – Get Active –Get Living) breast cancer program is to provide post-treated breast cancer patients individualized prescriptive exercise and recreational therapy designed to assist in the management of cancer treatment-related symptoms. All patients enrolled in Get-REAL & HEEL will work with a personal trainer and/or a recreational therapist to develop, implement, and participate in exercise and recreation activities. The overall program goal is to increase the chances of survivorship by providing patients with opportunities to strengthen their body and mind thereby contributing to increased quality of life post cancer treatment. The program will be offered **free of charge** to qualified individuals at EXSS facilities on the campus of UNC-CH under the supervision of UNC-CH Exercise and Sport Science Faculty and UNC-CH physicians.

**For further information,
please contact any of the
following:**

Dr. Diane Groff
Program Director
Phone: 919-962-0534
dgroff@email.unc.edu

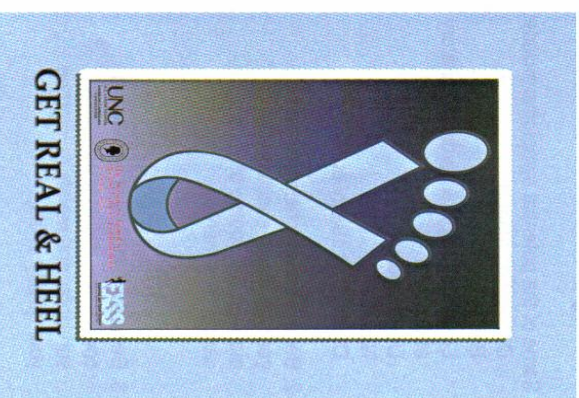
Dr. Claudio Battaglini
Program Director
Phone: 919-843-6045
claudio@email.unc.edu

Sandra Jarr, RN, MSN
Program Assistant Director
Phone: 919-966-1500
sjarr@unch.unc.edu

Alison Dancy
Program Assistant
Phone: 919-962-1222
amdancy@alumni.unc.edu

**The University of North Carolina
at Chapel Hill**
Department of Exercise & Sport Science &
The Lineberger Comprehensive Cancer Center

PRESENTS:



Program Sponsored By:



**The Susan G. Komen
Breast Cancer Foundation**
NC Triangle Affiliate



Why should you participate in Get REAL & HEEL???

1. Because it may help alleviate the symptoms you might be experiencing during and post-treatment

Some of the potential symptoms include:

- Debilitating fatigue
- Pain
- Loss of strength & cardio-respiratory endurance
- Depression
- Nausea
- Diminished quality of life

2. Because it may help you and your physician successfully manage the course of your cancer treatment.

3. Because it may help you regain confidence, network with other survivors, and mainly to improve your quality of life.

“Don’t look at the way things are and ask why - think about the way things could be and ask why not.”

Possible Benefits you can attain by participating in the program:

Physical benefits include: Increased strength, endurance, flexibility, cardio-respiratory health, and decreased fatigue.

Psychological benefits include: Increased self-confidence, self-esteem, optimism, coping skills, pain and stress management skills, enhanced feelings of acceptance, social support, personal empowerment, and overall quality of life.

Who is eligible to participate?

- Confirmed diagnosis of Stage I, II, or III invasive breast cancer;
- Within 3 months of completion of all planned surgery, radiation therapy, and chemotherapy.
- Ages ranging from 30 to 65 years
- Patients receiving adjuvant hormonal therapy or adjuvant trastuzumab are eligible.

What to I need to do to participate?

- Obtain written clearance for participation from your oncologist
- Contact one of the program directors listed in the back of this flier
- Set up a visit to the program facility (you need to bring your oncology clearance participation form during you visit)

Remember: Limited space is available for the year 2006. If interested, please contact one of the program directors as soon as possible.

What am I going to be doing if enrolled in the program?

You will participate in an exercise and recreation therapy program 3 times a week for 6 months.

Some of the exercises that you will be able to experience include:

cardiovascular activities on the treadmill, cross-trainer, stepper, and cycle ergometer; resistance exercises on exercise machines, dumbbells, rubber bands, and fit balls, and a variety of flexibility exercises designed to assist patients re-gain upper body and arm range-of-motion usually compromised by surgery.

Some of the recreation activities you will be able to experience include: a

host of individual and group activities designed to accomplish the goals and objectives identified in the patient's individual treatment plans. Individual recreational interventions might include: Cognitive and Behavioral Interventions for Pain and Stress Management, Relaxation Techniques, and Individual Leisure Education. Group recreational interventions might include: Walking Group, Ropes Challenge Course, Music Therapy, Arts, and Group Leisure Education.

Appendix II

Revised Piper Fatigue Scale



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	

© 1984, Barbara F. Piper; revised 7/10/97; reproduced with permission.

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

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	$\text{ } \div 6 = \text{ }$

Add $6+5+7+8+5 = 31 \div 5 = 6.2$ 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	$37.2 \div 6 = 6.2$

Patient Name: _____

Revised Piper Fatigue Scale Calculations

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

Appendix III
Center for Disease Control Depression Scale



Center for Epidemiologic Studies Depression Scale (CES-D), NIMH

Below is a list of the ways you might have felt or behaved. Please tell me how often you have felt this way during the past week.

	During the Past			
	Week			
	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I did not feel like eating; my appetite was poor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I felt that I could not shake off the blues even with help from my family or friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I felt I was just as good as other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I had trouble keeping my mind on what I was doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I felt depressed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I felt that everything I did was an effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I felt hopeful about the future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I thought my life had been a failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I felt fearful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. My sleep was restless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I was happy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I talked less than usual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I felt lonely.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. People were unfriendly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I enjoyed life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I had crying spells.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I felt sad.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I felt that people dislike me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I could not get "going."	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SCORING: zero for answers in the first column, 1 for answers in the second column, 2 for answers in the third column, 3 for answers in the fourth column. The scoring of positive items is reversed. Possible range of scores is zero to 60, with the higher scores indicating the presence of more symptomatology.

Appendix IV

Functional Assessment Cancer Treatment -Breast



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:

PHYSICAL WELL-BEING

- | | not at
all | a little
bit | some-
what | quite a
bit | very
much | | | | | | | |
|--|---------------|-----------------|---------------|----------------|--------------|---|---|---|---|---|----|--------------|
| 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:

SOCIAL/FAMILY WELL-BEING

- | | not at
all | a little
bit | some-
what | quite a
bit | very
much | | | | | | | |
|--|---------------|-----------------|---------------|----------------|--------------|---|---|---|---|---|----|--------------|
| 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:

RELATIONSHIP WITH DOCTOR

- | | not at
all | a little
bit | some-
what | quite a
bit | very
much | | | | | | | |
|--|---------------|-----------------|---------------|----------------|--------------|---|---|---|---|---|----|--------------|
| 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.....	①	②	③	④	⑤
21. I am proud of how I'm coping with my illness.....	①	②	③	④	⑤
22. I am losing hope in the fight against my illness.....	①	②	③	④	⑤
23. I feel nervous.....	①	②	③	④	⑤
24. I worry about dying.....	①	②	③	④	⑤
25. How much does your EMOTIONAL WELL-BEING affect your quality of life?	Not at all 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).....	①	②	③	④	⑤
27. My work (include work in home) is fulfilling.....	①	②	③	④	⑤
28. I am able to enjoy life "in the moment".....	①	②	③	④	⑤
29. I have accepted my illness.....	①	②	③	④	⑤
30. I am sleeping well.....	①	②	③	④	⑤
31. I am enjoying my usual leisure pursuits.....	①	②	③	④	⑤
32. I am content with the quality of my life right now.....	①	②	③	④	⑤
33. How much does your FUNCTIONAL WELL-BEING affect your quality of life?	Not at all 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.....	①	②	③	④	⑤
35. I am self-conscious about the way I dress.....	①	②	③	④	⑤
36. My arms are swollen or tender.....	①	②	③	④	⑤
37. I feel sexually attractive.....	①	②	③	④	⑤
38. I have been bothered by hair loss.....	①	②	③	④	⑤
39. I worry about the risk of cancer in other family members.....	①	②	③	④	⑤
40. I worry about the effect of stress on my illness.....	①	②	③	④	⑤
41. I am bothered by a change in weight.....	①	②	③	④	⑤
42. I am able to feel like a woman.....	①	②	③	④	⑤
43. How much do these ADDITIONAL CONCERNS affect your quality of life?	Not at all ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ Very much so				

Appendix V

International Physical Activity Questionnaire

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (August 2002)

SHORT LAST 7 DAYS SELF-ADMINISTERED FORMAT

FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health-related physical activity.

Background on IPAQ

The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

Using IPAQ

Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation

Translation from English is supported to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ

International collaboration on IPAQ is on-going and an ***International Physical Activity Prevalence Study*** is in progress. For further information see the IPAQ website.

More Information

More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective*. Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ days per week

☐

No vigorous physical activities → **Skip to question 3**

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ days per week

☐

No moderate physical activities → **Skip to question 5**

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐

No walking



Skip to question 7

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

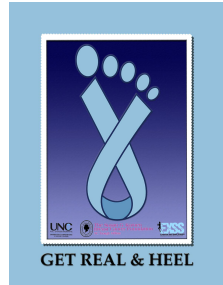
☐

Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

Appendix VI

Pre Assessment Guidelines for Physiological Assessments



Assessment Pretest Guidelines

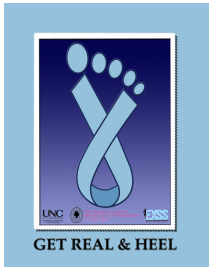
Body Composition Analysis

To assure the best possible accuracy of the information obtained from the body composition assessments, please follow the instructions listed below:

1. No eating or drinking 2 hours prior to testing.
2. Void completely before the assessment.
3. Please wear appropriate clothing for the assessments
4. No exercise 24 hours prior to testing.
5. No alcohol consumption 48 hours prior to testing.
6. No diuretic medications 7 days prior to testing.

Source: advanced Fitness Assessment Exercise Prescription – Fifth Edition – Vivian H. Heyward

Appendix VII
Resting Vitals Data Sheet



Get REAL & HEEL Breast Cancer Program

University of North Carolina at Chapel Hill

Department of Exercise and Sport Science

Lineberger Comprehensive Cancer Center

INITIAL ASSESSMENT: Data Collection Sheet

Date/Day of Week: _____

Participant Name: _____

Trainer: _____

Attach the Polar Heart Rate monitor immediately after patient arrives. Heart rate monitor should not be removed until the patient completes all tests. Patient should remain seated for 5 minutes while the lowest heart rate measure is observed and recorded

Start Time: _____

Completion Time: _____

BP: _____

RHR: _____ bpm

Method used for RHR: _____

Pulse Oximeter Reading: SpO₂ _____ %

Final SpO₂ _____ %

Height: _____ cm (shoes / no shoes)

Weight: _____ kg (shoes / no shoes)

Type of shoes, if applicable: _____

Inch to Centimeter conversion: 1 inch = 2.54 centimeters

_____ in x 2.54cm = _____ cm

Appendix VIII
Modified Bruce Protocol

Date/Day of Week: _____

Participant Name: _____

Trainer: _____

Cardio-respiratory Endurance Test

Modified Bruce Protocol: Treadmill

Sub-maximal treadmill test (Time to exhaustion at 75% predicted max)

Test termination: Subjects will be asked to walk/jog at a target sub-maximal intensity of 75% of their percentage of heart rate range (Karvonen % HRR & predicted maximal heart rate) until a RPE (Rate of Perceived Exertion) of 7 is reached on the modified Borg Scale

Karvonen Formula:

$$\text{Target Heart Rate} = (HR_{\max} - HR_{\text{rest}}) \times \text{percent intensity} + HR_{\text{rest}}$$

Where:

HR_{\max} = 220-age of the participant

HR_{rest} = Resting heart rate,

Percent Intensity= Prescribed exercise intensity

$$\text{Target HR} = (\text{_____} - \text{_____}) \times 0.75 + \text{_____}$$

$$\text{Target HR} = \text{_____}$$

Stage	Speed	Grade	Stage Time	HR	RPE	Total Time
Warm-up	1.7 mph	0%	3 min			
One	1.7 mph	10%	3 min			
Two	2.5 mph	12%	3 min			
Three	3.4 mph	14%	3 min			
Four	4.2 mph	16%	3 min			
Five	5.0 mph	18%	3 min			

$$\text{VO}_2 \text{ calculation formula: } VO_{2\max} = 2.282 (\text{time in min.}) + 8.545$$

$$VO_{2\max} = 2.282 (\text{_____}) + 8.545$$

$$VO_{2\max} = \text{_____}$$

Heyward, H.V. (2006). *Advanced Fitness Assessment and Exercise Prescription. Fifth Edition*, Champaign, Illinois: Human Kinetics, pp.56.

Appendix IX

Overall Muscular Endurance Test

Date/Day of Week: _____

Participant Name: _____

Trainer: _____

Overall Muscular Endurance Test

General Exercise Endurance test

Push-ups : Count to three seconds when pushing up and another three going down to control rhythm of exercise. Stop exercise when positioning or rhythm changes due to fatigue, an RPE of 7/10 is reached or client stops on their own.

Abdominal Crunch (regular): Patient lies supine on a mat with knees in 90 degrees flexion and arms at the sides. Count to 3 for flexion of trunk and another count to 3 for extension of trunk. Stop exercise when positioning or rhythm changes due to fatigue, an RPE of 7/10 is reached or client stops on their own.

Exercise Specific Endurance tests:

Biceps Curls Patient will be standing feet shoulder width apart holding the dumbbells, palm side up, at their side. The patient will then bring the weight up to shoulders bending at the elbow for a controlled cadence (“up 2, 3, down 2,3”). Stop exercise when cadence is broken, an RPE of 7/10 is reached or client stops on their own. Repetitions will be counted individually for the right and left arm.

Leg Extension: Patient will be using a leg extension machine to perform this exercise. The Patient will start seated with both legs bent at a 90 degree angle and will extend both legs to near full extension (not locking knees) and then return to starting position continuing in a controlled motion. Stop exercise when positioning or rhythm changes due to fatigue, an RPE of 7/10 is reached or client stops on their own.

Important considerations:

1. Ensure that subjects are properly “warmed-up” before initiation of the test protocol.
2. Patients should perform as many complete repetitions as possible, until an RPE of 7 is reached.
3. Compute “weight to be lifted” according to age and body weight specifications outlined.
4. Assist the client with the 1st repetition and then continue to “spot” throughout the test.
5. Repetitions should be performed at a controlled cadence (“1, 2, 3” – Up, “1, 2, 3” – Down).
6. Stop participant at 25 repetitions if RPE has not reached 7.

% BODY WEIGHT TO BE LIFTED

Exercise	Age<45	Age 45-60	Age 60-70	Age>70
	Women	Women	Women	Women
Biceps curl L arm	.065	.061	.058	.055
Biceps curl R arm	.065	.061	.058	.055
Leg Extension	.375	.350	.330	.310

Formula to determine “weight to be lifted”:

$$BW \times \text{Protocol Percentage (constant for the exercise)} = \text{Exercise Load}$$

Exercise	Body Weight	%	Machine weight	Weight to be lifted	# of Reps
			Setting		
Right Arm Bicep Curls					
Left Arm Bicep Curls					
Leg Extension					
Push Ups					
Abdominal Crunches					
				Total # Reps	

Leg Ext - each plate = 12.5 lbs

References

- Ainsworth, B., Haskell, W., Leon, A. (1993). Compendium of physical activities: classification of energy costs of human physical activities. *Med. Sci. Sports. Exerc.* 25, 71-80.
- American Cancer Society. (2006). Retrieved October 30, 2006, from the world wide web: http://www.cancer.org/docroot/CRI/CRI_2_1x.asp?dt=5
- Battaglini, C. L., Boltaro, M., Campbell, J. S., Novaes, J., Simao, R. (2004). Physical activity and levels of fatigue in cancer patients. *Rev. Bras. Med. Esporte*, 10 (2), 105-110.
- Blanchard, C.M., Baker, F., Denniston, M.M., Courneya, K.S., Hann, D.M., Gesme, D.H., Reding, D., Flynn, T., Kennedy, J.S. (2003). Is absolute amount or change in exercise more associated with quality of life in adult cancer survivors? *Prev. Med.* 37(5), 389-395.
- Bowers, J.D., Ganz, P.A., Desmond, K.A., Rowland, J.H., Meyerowitz, B.E., Belin, T.R. (2000). Fatigue in breast cancer survivors: occurrence, correlates, and impact on quality of life. *J. Clin. Oncol.* 18, 743-753.
- Brady, M.J., Cella, D.F., Mo, F., Bonomi, A.E., Tulsky, D.S., Lloyd, S.R., Deasy, S., Cobleigh, M., Shiimoto, G. (1997). Reliability and validity of the functional assessment of cancer therapy breast quality of life instrument. *J. Clin. Oncol.* 15(3), 974-986.
- Courneya, K. S., Mackey, J. R., Bell, G. J., Jones, L. W., Fields, C. J., Fairey, A. S. (2003). Randomized controlled trial of exercise training in premenstrual breast cancer survivors: cardiopulmonary and quality of life outcomes. *J. Clin. Onc.*, 12 (9), 1660-1668.
- Courneya, K.S., Freidenreich, C.M., Sela, R.A., Quinney, H.A., Rhodes, R.E., Handman, M. (2003). The group psychotherapy and home based physical exercise (group-hope) trial in cancer survivors: physical fitness and quality of life outcomes. *Psycho-Oncol.* 12, 357-374.
- Craig, C.L., Marshall, A.L., Sjostrom, M., Bauman, A.E., Booth, M.L., Ainsworth, B.E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J.F., Oja, P. (2003). International physical activity questionnaire: 12 country reliability and validity. *Med. Sci. Sports. Exerc.* 35(8), 1381-1395
- Degate, N. (2006). Walk for the cure. *ACE Certified News*, Feb/Mar, 03-05
- Dimeo, F. C. (2001). Effects of exercise on cancer related fatigue, Cancer related fatigue: new directions for research. *Cancer Supp.*, 92 (6), 1689-1693.

- Dimeo, F. C., Steiglitz, R., Novelli-Fischer, U., Fetscher, S., Keul, J. (1999). Effects of physical activity on the fatigue and psychologic status of cancer patients during chemotherapy. *Cancer*, 85, 2273-2277
- Dimeo, F. C., Rumberger, B. G., Keul, J. (1998). Aerobic exercise as therapy for cancer fatigue. *Med. Sci. Sport. Exerc.*, 30 (4), 475-478
- Dimeo, F. C., Fetscher, S., Lange, W., Mertelsmann, R., Keul, J. (1997). Effects of aerobics exercise on physical performance and incidence of treatment related complications after high dose chemotherapy. *Blood*, 90 (9), 3390-3394.
- Dimeo, F. C., Tilman, M. H., Bertz, H., Kanz, L., Mertelsmann, R., Keul, J. (1997). Aerobics exercise in rehabilitation of cancer patients after high dose chemotherapy and autologous peripheral stem cell transplantation. *Cancer*. 79 (9), 1717-1721.
- Ganz, P.A., Coscarelli, A., Fred, C., Kahn, B., Polinsky, M.L., Petersen, L. (1996). Breast cancer survivors: psychosocial concerns and quality of life. *Breast Cancer Res. Treat.* 38, 183-199.
- Hann, D., Winter, K., Jacobson, P. (1999), Measurement of depressive symptoms in cancer patients: evaluation of the Center for Epidemiological Studies Depression Scale (CES-D). *J. Psychosom. Res.* 46(5), 437-443
- Hayes, S., Davies, P.S.W., Parker, T., Bashford, J., Newman, B. (2004). Quality of life changes following peripheral blood stem cell transplantation and participation in a mixed type moderate intensity exercise program. *Bone Marrow Transplantation*. 33, 553-558.
- Hernandez-Reif, M., Ironson, G., Field, T., Hurley, J., Katz, G. Diego, M., Weiss, S., Fletcher, M.A., Schanberg, S., Kuhn, C., Burman, I. (2004). Breast cancer patients have improved immune and neuroendocrine functions following massage therapy. *J. Psychosomatic Res.* 57, 45-52.
- Herrero, F., Balmer, H., San Juan, A.F., Foster, C., Fleck, S.J., Perez, M., Canete, S., Earnest, C.P., Lucia, A. (2006). Is cardiorespiratory fitness related to quality of life in survivors of breast cancer? *J. Strength Con. Res.* 20(3), 535-540.
- Herrero, F., San Juan A.F., Fleck, S.J., Foster, C., Lucia, A. (2006). Effects of detraining on the functional capacity of previously trained breast cancer survivors. *Int. J. Sports. Med* (in Press).
- Holmes, M.D., Chen, W.Y., Feskanich, D., Kroenke, H.C., Colditz, G.A. (2005). Physical activity and survival after breast cancer diagnosis. *JAMA*, 293 (20), 2479-2486.
- Irwin, M.L., McTiernan, A., Bernstein, L., Gilliland, F.D., Baumgartner, R., Baumgartner,

- K., Ballard-Barbash, R. (2004). Physical activity levels among breast cancer survivors. *Med. Sci. Sport. Exerc.* 36 (9), 1484-1491.
- Jereczek-Fossa, B. A., Marsiglia, H. R., Orecchia, R. (2002). Radiotherapy-related fatigue. *Crit. Rev. Oncol. Hemat.* 41, 317-325.
- Jones, L.W. & Courneya, K.S. (2002). Exercise counseling and programming preferences of cancer survivors. *Cancer Practice.* 10 (4), 208-214.
- McKenzie D.C. & Kalda, A.L. (2003). Effects of upper extremity exercise on secondary lymphedema in breast cancer patients: a pilot study. *J. Clin. Oncol.* 21(3), 463-466.
- National Cancer Institute (2006, April 16) Cancer Trends Progress Report 2005 Update Retrieved October 30, 2006 from the world wide web:
http://progressreport.cancer.gov/doc_detail.asp?pid=1&did=2005&chid=25&coi=227&mid=
- Ohira, T., Schmitz, K.H., Ahmed, R.L., Yee, D. (2006). Effects of weight training on quality of life in recent breast cancer survivors. *Cancer.* 106 (9), 2076-2083.
- Pinto, B.M., Trunzo, J.J., Reiss, P., Shiu, S. (2002). Exercise participation after diagnosis of breast cancer: trends and effects on mood and quality of life. *Psycho-oncol.* 11, 389-400.
- Pinto, B.M., Clark, M.M., Maruyama, N.C., Feder, S.I., (2003). Psychological and fitness changes associated with exercise participation among women with breast cancer. *Psycho-Oncol.* 12, 118-126.
- Piper, B.F., Dibble, S.L., Dodd, M.J., Weiss, M.C., Slaughter, R.E., Paul, S.M. (1998). The revised piper fatigue scale: psychometric evaluation in women with breast cancer. *Oncol. Nurs. Forum.* 25(4), 677-84.
- Rogers, L.Q., Matevey, C., Hopkins-Price, P., Shah, P., Dunnington, G., Courneya, K.S. (2004). Exploring social cognitive theory constructs for promoting exercise among breast cancer patients. *Cancer Nurs.* 27(6), 462-473.
- Schmitz, K.H., Ahmed, R.L., Hannan, P.J., Yee, D. (2005). Safety and efficacy of weight training in recent breast cancer survivors to alter body composition, insulin, and insulin like growth factor axis proteins. *Cancer. Epidemiol. Biomarkers Prev.* 14(7), 1672-1680.
- Schwartz, A.L., Mori, M., Gao, R. Nail, L.M., King, M.E. (2001). Exercise reduces daily fatigue in women with breast cancer receiving chemotherapy. *Med. Sci. Sports. Exerc.* 33 (5), 718-723.
- Schwartz, A. L. (1999). Fatigue mediates the effects of exercise on quality of life. *Quality of*

Life Research, 8, 529-538.

Segal, R. J., Reid, R. D., Courneya, K. S., Malone, S. C., Parliament, M. B., Scott, C. G., Vanner, P. M., Quinney, H. A., Jones, L. W., Slovin, D'Angelo, M. E., Wells, G. A. (2003). Resistance exercise in men receiving androgen deprivation therapy for prostate cancer. *J. Clin. Oncol.* 21, 1653-1659

Shannon, C. S. (2005). Breast cancer treatments: The effect on and therapeutic role of leisure. *Am. J. Rec. Ther., Summer*, 25-30.

Shannon, C.S. & Shaw, S. M. (2005). "If the dishes don't get done today, they'll get done tomorrow": A breast cancer experience as a catalyst for changes to woman's leisure. *J. Leis. Res.* 37 (2), 195-215.

Singh, B., Cheema, B., Gaul, C.A. (2006). Full body exercise training improves fitness and quality of life in survivors of breast cancer. *J. Strength Cond. Res.* 20 (1), 14-21.

Surveillance, Epidemiology, and End Results (SEER) Program (April 2006)
Retrieved October 30, 2006 from the world wide web: www.seer.cancer.gov

Thorsen, L., Skovlund, E., Stomme, S.B., Hornslien, K., Dahl, A.A., Fossa, S.D. (2005). Effectiveness of physical activity on cardiorespiratory fitness and health related quality of life in young and middle aged cancer patients shortly after chemotherapy. *J. Clin. Oncol.* 23(10), 2378-2388.