The Effects of Exercise Intensity and Self-Efficacy on State-Anxiety with Breast Cancer Survivors

by

Rachel Blacklock
B.Sc., University of Victoria, 2004

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In the School of Exercise Science, Physical & Health Education

SUPERVISORY COMMITTEE

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Dr. Ryan. E. Rhodes, (Department of Exercise Science, Health and Physical Education)
Supervisor

Dr. C.A. Gaul, (Department of Exercise Science, Health and Physical Education)
Departmental Member

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ABSTRACT

INTRODUCTION: Anxiety has been thoroughly reported in response to the treatment of breast cancer, however, the research examining the effects of acute exercise among breast cancer survivors is limited. Only one study, primarily exploratory in design, has examined the anxiolytic effects of acute exercise with breast cancer survivors. PURPOSE: 1) Determine whether acute exercise reduces state anxiety in breast cancer survivors and those without a cancer diagnosis in a similar fashion, 2) Investigate the difference between exercise intensity conditions for pre-post and post-after state anxiety changes, 3) Examine whether changes in self-efficacy are reciprocal with the changes in state anxiety, and 4) Explore selected moderator variables of the exercise-state anxiety relationship. METHODS: Twenty-five breast cancer survivors and twenty-five age-matched women without a cancer diagnosis cycled for 20 minutes at light and moderate intensities on two separate occasions. State anxiety and self-efficacy measures were completed before, immediately following and 10 minutes post exercise. RESULTS: 2 x 3 RM ANOVA revealed a main effect for time for both light and moderate conditions ($F_{(2, 46)} = 10.09$, $p < .01$, $\eta^2 = .18$ and $F_{(2, 47)} = 22.34$, $p < .01$, $\eta^2 = .32$ respectively) but between group interaction effects were not significant. For self-efficacy, 2 x 3 RM ANOVA found main effects for both light and moderate conditions (light exercise $F_{(2, 41)} = 9.82$, $p < .01$, $\eta^2 = .19$; moderate exercise $F_{(2, 44)} = 4.86$, $p < .01$, $\eta^2 = .10$) with no between group interaction effects. Correlations between anxiety

and self-efficacy change scores showed moderate associations for light condition post-after exercise ($r = .50$, $p < .01$) and moderate condition pre-post exercise ($r = .29$, $p < .05$). In a secondary analysis, groups median split on high/low trait anxiety showed significant differences between groups (light exercise $F_{(1,43)} = 5.05$, $p < .05$, $\eta^2 = .11$; moderate exercise $F_{(1,44)} = 6.16$, $p < .05$, $\eta^2 = .12$) as did results median split by pre-exercise state anxiety levels (light exercise $F_{(1,45)} = 33.21$, $p < .01$, $\eta^2 = .45$; moderate exercise $F_{(1,46)} = 58.93$, $p < .01$, $\eta^2 = .56$).
CONCLUSION: Exercise decreases state anxiety for breast cancer survivors and the general population alike. However, this relationship appears to be moderated by trait anxiety and pre-exercise anxiety. Self-efficacy is important for dose-response and theory-based exercise prescriptions, but future research should focus on subpopulations known to posses high levels of anxiety and poor exercise self-efficacy.

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ACKNOWLEDGMENTS

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I would also like to thank all of the women that volunteered for my study, including many members if the Island Breast Strokers, the Canadian Cancer Society, and former patients and nurses at VGH.

A big thank you to my family for their love and support.

DEDICATION

I would like to dedicate this thesis to all of the inspirational women that have touched my life, including those I had the privilege of meeting through this project. In particular, I would like to dedicate this book to my greatest inspirations, my mother and sister, Sharon and Alexa Blacklock. You are fuel for my perseverance and a constant reminder of what is most important. Also, thank you to all my family and friends who ever listened to me say the words, "I can't _____ because I need to _____ for my thesis project…" I am grateful for all of your understanding and support.

CHAPTER 1: MANUSCRIPT

INTRODUCTION

Breast cancer is the most common cancer diagnosis in women (Canadian Cancer Statistics, 2007). Due to advancement in screening, a growing population and effective treatment methods, the number of breast cancer survivors has risen and is expected to keep rising over the next two decades. Therefore, recent research has focused on many of the physical and psychological challenges preventing an optimal quality of life that extend beyond just recovery of the cancer itself. The term 'cancer survivor' may be used to describe someone previously diagnosed with cancer and for the continuation of their life (National Coalition of Cancer Survivorship, 2005).

Anxiety is often reported in response to diagnoses and treatment of cancer (Bottomley, 1997; Fulton, 1999; Newell, Sanson-Fisher, Girgis, & Ackland, 1999; Stefanek, Derogatis & Shaw, 1987), however, the presence of state anxiety among breast cancer survivors empirically remains inconclusive (Thomas, et al., 1997; Rothrock et al., 2004; Saleeba, Weitzner & Meyers, 1996). There are many types and definitions of anxiety. Bottomley (1998) describes anxiety as an uneasy and unpleasant feeling of potential harm or distress that often occurs in the absence of an obvious stimulus. It develops in association with cognitive processes pertaining to the inability to cope and can be divided into two types: state and trait anxiety. State anxiety refers to the moment-to-moment variations in the intensity of an individual's thoughts and feelings of apprehension (Martens, Vealey & Burton, 1990, p9). Trait anxiety is a personality characteristic describing how prone an individual is to experiencing episodes of anxiety (Marten et al., 1990, p9). State anxiety is related to the cancer experience through thoughts and feelings of the disease and the future (Bottomley, 1998; Spencer et al., 1999; Stefanek et al., 1989).

In the general population, acute exercise has been consistently demonstrated to reduce state anxiety (Callaghan, 2004; Petruzzello, Landers, Hatfield, Kabitz, & Salalzar, 1991; Motl & Dishman, 2004; Youngstedt, O'Connor, Crabbe, & Dishman, 1998). With breast cancer survivors, the effect of habitual exercise has also been reported to decrease state anxiety (Segar et al., 1998). To date, only one study, primarily exploratory in design, has examined the anxiolytic effects of acute exercise with breast cancer survivors (Blanchard, Courneya and Laing, 2001). This study reported findings consistent with the previous literature regarding acute exercise in the general population (Callaghan, 2004; Petruzzello et al., 1991; Motl & Dishman, 2004, Youngstedt et al., 1998). The author, however, reported a larger effect size (d = .7) than the effects reported in meta-analyses (Petruzzello et al., 1991 & Schlicht, 1994) concerning the general population (d = 0.23, and 0.15 respectively). This suggests that the anxiolytic effect of exercise may even be more important for cancer survivors compared to the general population. Limitations identified in the study by Blanchard et al. (2001) included lack of a control group and lack of separate exercise intensity conditions. A study extending on the work by Blanchard et al. (2001) will provide information regarding the presence of state anxiety and the appropriate exercise prescription needed to reduce anxiety with breast cancer survivors and those women without a cancer diagnosis.

Moderating Variables

While the anxiety-reducing effects of exercise have been amply reported in the general population, literature regarding the optimal exercise intensity for reducing anxiety remains inconsistent (Cox, Thomas, Hinton, & Donahue, 2004; Raglin & Wilson, 1996; Tieman, Peacock, Cureton & Dishman, 2002). Many researchers have attempted to explain the variation across study results by pointing to a lack of theoretical variables and moderating variables such

as pre-exercise anxiety, trait anxiety, outcome expectation and physical activity history that may influence the relationship between exercise intensity and anxiety (Blanchard et al., 2001; Ekkekasis & Petruzzello, 1999; Katula, Blissmer, & McAuley, 1999; Motl, O'Connor & Dishman, 2004; Steinhardt & Dishman, 1989, Tieman et al., 2002). The present study will test the proposed moderators of previous studies on the relationship between anxiety and exercise in a secondary exploratory analysis.

Social Cognitive Theory

A theory that has been applied to the anxiolytic effects of exercise is Bandura's social cognitive theory (SCT) (Bandura, 1986). SCT describes how an individual's behaviour, cognition, and environmental influences all interact to predict and explain behaviour. The foundation of SCT is self-efficacy. In the physical activity domain, exercise self-efficacy refers to one's beliefs about the capability to successfully engage in incremental bouts of physical activity. Self-efficacy influences a person's exercise behaviour such that a stronger sense of exercise self-efficacy results in a more favourable response to exercise and these favourable responses will serve to further boost self-efficacy (Bandura, 1997). A few studies have examined exercise and self-efficacy and report partial support for the theory (Butki, Rudolph & Jacobsen, 2001; Katula et al., 1999; Marquez, Jerome, McAuley, Snook, Canaklisova, 2002). Suggestions from previous research include identifying activity history among participants and choosing exercise intensities that will be challenging enough to change self-efficacy. A theory-based study incorporating the variables suggested by previous studies will provide further insight into the mechanism behind the anxiolytic effects of exercise and will allow for specific exercise prescription recommendations for those suffering from anxiety.

Alternative Theories

The inclusion of trait anxiety as a moderator variable relies on the assumption that state anxiety and trait anxiety are unidimensional constructs. An alternative theory describes trait and state anxiety as multidimensional constructs (Endler, Parker, Bagby, & Cox, 1991). Apart from the purely psychological theories used to help explain the effects of acute exercise on reduction in anxiety, there exist many other psychological theories routed in physiology. These theories include the monamine hypothesis (Brown, Payne, Kin, Moore, & Martin, 1979), endorphin hypothesis (Christie & Chesher, 1982), and opponent-process hypothesis (Solomon, 1980). All of these theories use biological mechanisms such as the actions of neurotransmitters, levels of endorphins or cerebral blood flow to help explain improvement in mood post-exercise. Although these theories will not be investigated in the present study, they will be considered as alternative hypotheses.

The purpose of this study is to: 1) determine whether acute exercise reduces state anxiety in cancer survivors and whether the effect differs from those without a cancer diagnosis, 2) investigate the potential difference between exercise intensity conditions for pre-post and post-after exercise state anxiety changes, 3) examine whether changes in self-efficacy reciprocate changes in state anxiety across exercise intensity conditions, as described by SCT, and 4) explore whether selected variables moderate the relationship between acute exercise and state anxiety.

Based on SCT and previous literature, it is hypothesized that: 1) acute exercise will decrease state anxiety for cancer survivors and those without a cancer diagnosis with greater reductions observed for cancer survivors, 2) light and moderate exercise intensity conditions will significantly differ in state anxiety changes, pre-post and post-after exercise, 3) changes in self-efficacy will reciprocate a reduction in state anxiety such that the greatest decrease will be

observed at intensity levels that are optimally challenging and thus, self-efficacy-enhancing, for the individual.

METHOD

Participants

A total sample of fifty subjects, half being breast cancer survivors, were recruited from the Victoria area. Table 1 displays demographic information for breast cancer survivors and those without a cancer diagnosis. Mean age of breast cancer survivors and those without a diagnosis was 59 and 56 years respectively. In general, the sample was well educated with about 40% having at least a Bachelors degree. Over 70% had a household income of $40,000 and approximately 80% were married or living with a partner. Physical activity levels were just above the provincial average (64%) with more than 66% were meeting the recommended guidelines set by the American College of Sports Medicine (1998) for weekly physical activity (Canadian Fitness and Lifestyle Research Institute, 2002). Pearson's chi-square analysis showed no significant differences between groups.

Recruitment

Upon ethical approval by the University of Victoria, recruitment posters were displayed at local breast cancer support centres, community centres, recreation centres, and hospitals (appendix C). A brief talk was also given to the Island Breast Strokers dragon boat team. Interested participants were asked to contact the primary investigator to be screened for eligibility and receive a research package. The research package included information regarding the study, a participant

consent form, a medical clearance form requiring a physician's signature to participate in two acute exercise bouts, a Physical Activity Readiness Questionnaire (PAR-Q) (Canadian Society for Exercise Physiology, 1994), and a participant profile questionnaire including demographic/medical variables, the adapted Leisure-Time Exercise Questionnaire (LTEQ) (Godin, Jobin & Bouillon, 1986; Godin & Shepard, 1985), outcome expectations

Table 1.

Descriptives for Breast Cancer Survivors Versus Those Without A Cancer Diagnosis

Factors	Cancer Survivor (N = 25)			Without Diagnosis (N = 25)		
	%	M	SD	%	M	SD
Age	-	59	11.3	-	56.0	14.9
Race	95.7 Caucasian	-	-	95.7 Caucasian	-	-
Education						
≥ High school	8.7	-	-	21.7	-	-
≥ Diploma (college/university)	60.0	-	-	60.9	-	-
≤ Bachelor degree	40.0	-	-	39.1	-	-
Annual Income						
≤ $20,000	8.7	-	-	19.0	-	-
$20,001- 40,000	13.0	-	-	9.5	-	-
> $40,000	78.2	-	-	71.5	-	-
Marital Status						
Never Married/Widowed	8.0	-	-	8.3	-	-
Separate/Divorced	12.0	-	-	12.5	-	-
Living with a Partner	20.0	-	-	16.7	-	-
Married	60.0	-	-	62.5	-	-

questionnaire (Steinhardt & Dishman, 1989) and the trait anxiety questionnaire (TAI) (Speilberger et al., 1983) (appendices D, F, & G). Participants (breast cancer survivors only) sought approval to participate in the study from their general practitioner (appendix E). Criterion sampling was used to select eligible participants. Participants had to be over the age of 18 and be physically able to engage in low to moderate exercise intensity sessions as confirmed by a doctor and/or the PAR-Q (appendix G). Breast cancer survivors also had to have completed treatment. Breast cancer survivors and participants without a cancer diagnosis were aged-matched ($p < .05$).

Pre-Test

Upon arrival to the lab, participants were randomly assigned to a light or moderate intensity condition, fitted with a heart rate monitor and familiarized with the Borg rating of perceived exertion (RPE) scale (Borg, 1998) (appendix K). Each participant was asked to complete both moderate and light intensity exercise conditions on two separate days. The order of conditions was counter-balanced.

A resting heart rate was taken after five minutes of seated rest. From the resting heart rate value, Karvonen's heart rate reserve (HRR) and target heart rate range was calculated to define the intensity each individual participant must stay within during their bout of exercise (Heyward, 2002). A five minute warm-up pedaling at 60 revolutions per minute (rpm) was implemented prior to test start (Treasure & Newbery, 1998). The state anxiety inventory (SAI) (Speilberger et al., 1983) and self-efficacy questionnaire (SEQ) for either light or moderate intensity exercise was completed pre-exercise test (appendices H, I & J).

Test

Participants cycled for 20 minutes maintaining a cadence of 60 revolutions per minute, staying within the HRR range. The light-intensity group cycled at 30-35%HRR and the

moderate-intensity group cycled at 60-65%HRR (Heyward, 2002). Heart rate and RPE were recorded every two minutes during the test and resistance was adjusted accordingly in order to maintain the designated heart rate range (appendix K).

End of Test

The SAI and SEQ was completed again immediately post-exercise. Participants then cooled down at a preferred cadence for 2 minutes, dismounted the bike and were asked to sit for 8 minutes before completing the SAI and SEQ for a third time (after-exercise). Heart rate was recorded at this time.

Instruments & Measures

Participant Profile included (Demographic/Medical Questions, Physical Activity History, Outcome Expectations Questionnaire and Trait Anxiety Inventory):

Demographic/Medical Questionnaires

Demographic/Medical variables were assessed by self-report, and consisted of age, ethnicity, marital status, education, employment, time since diagnosis, and date and types of treatments completed.

Physical Activity History

An adapted version of the Leisure-Time Exercise Questionnaire (LTEQ) was used to assess the number of times, on average, a person engaged in strenuous, moderate and mild activities in their free time for at least 15 minutes during a typical week (Godin et al., 1986; Godin & Shephard, 1985). Previous literature has shown that the LTEQ possesses adequate reliability and validity at moderate and strenuous intensities (Jacobs, Ainsworth, Hartmen, & Leon, 1993).

Outcome Expectation

A 12-item questionnaire asked questions regarding expected outcomes related to exercise using a 5-point Likert scale (Steinhardt & Dishman, 1989). Possible answers ranged from strongly disagree (1), to strongly agree (5). Cronbach's reliability coefficient $\alpha = .86$.

State-Anxiety/Trait-Anxiety

The 20-item form of Spielberger's Trait Anxiety Inventory Y2 (TAI) (Speilberger et al., 1983, Y2) was used to assess trait anxiety, while the 10-item State-Anxiety Inventory Y1 (SAI) short form (Speilberger et al., 1983, Y1) was used to assess state anxiety. With both questionnaires, individuals were asked to rate their current feelings on a four-point scale ranging from "not at all (1)" to "very much so (4)". The items are summed to produce a total score in which higher scores are related to greater anxiety. The trait anxiety questionnaire asks how one is feeling "in general", while the state anxiety questionnaire asks how one is feeling "right now". Research has supported reliability and validity for both TAI and SAI across exercise time points ($\alpha = .91$, $\alpha > .71$ respectively).

Self-Efficacy

Self-efficacy was assessed using an adapted questionnaire from previous literature (Katula et al., 1999; Tressure & Newberry, 1998). The questionnaire asked participants to rate their beliefs in their physical capability to cycle incremental distances from 5 minutes to 60 minutes at either light or moderate intensity. For each item, participants were asked to indicate their confidence on a 100-point percentage scale. This 100-point scale was comprised of 10-point increments, ranging from 0% (not at all confident) to 100% (highly confident). A total self-efficacy score was calculated by summing the confidence ratings, and then dividing the summed ratings by the total number of items in the scale, resulting in a maximum possible efficacy score

of 100. This measurement strategy is consistent with Bandura's guidelines for measuring self-efficacy and has been widely used in the physical activity literature (Blanchard, Rodgers, Courneya & Spence, 2002; Katula et al., 1999; McAuley, Talbot & Martinez 1999; Tressure & Newberry, 1998). Cronbach's reliability coefficient $\alpha > .91$ across exercise time points.

Heart Rate and Ratings of Perceived Exertion

Heart rate will be measured with a Polar A3 heart rate monitor and perceived exertion was measured using Borg's Rating of Perceived Exertion scale (RPE) (Borg, 1998) which required participants to rate, on a 15-point scale (from 6 to 20), their perceptions of exertion during exercise. The scale ranges in description from "very, very light (7)" to "very, very hard (19)". Literature surrounding the use of RPE scales to determine exercise intensities reports its criterion-validity as moderate ($r = 0.6$ for heart rate, blood lactate, VO2max, VO2, and ventilation; Chen, Fan & Moe, 2002).

Statistical Analysis

Information regarding potential moderators and main variables were displayed using descriptive statistics. Differences between cancer survivors and those without a cancer diagnosis for potential moderators and dependant variables were tested using Pearson's chi-square analysis and one-way analyses of variance (ANOVA).

Test of Assumptions

The ANOVA assumption of homogeneity of variance was checked for both state anxiety and self-efficacy variables using Mauchly's test of sphericity and Levene's homegeneity test of variance.

State-Anxiety Inventory: Item Consistency

Previous literature surrounding state anxiety and acute exercise caution the use of the state-anxiety inventory (SAI) (Spielberger et al., 1983) with moderate exercise and immediately following vigorous exercise because of the potential inverse relationship between physical and emotional arousal during exercise (Ekkekakis, Hall, and Petruzzello, 1999; Rejeski, Hardy, & Shaw, 1991). To check for within item consistency, repeated one-way analyses of variance using individual items within the state anxiety inventory instead of total item means was calculated.

Outcome Variables

To determine whether acute exercise reduces state anxiety and whether this differs from those without a cancer diagnosis, a 2 (group) x 3 (time) repeated measures analysis of variance (ANOVA) was used for each exercise intensity condition. Tukey's post-hoc determined which measures specifically differed from each other. The same analyses were run with self-efficacy as the dependent variable. To investigate the potential moderating impact of exercise intensity on pre-post and post-after exercise state anxiety changes, t-tests between light and moderate intensities were run at pre, post, after and change score (pre-post, post-after and after-pre) time points. Alternatively, a two-way repeated measures ANOVA was also run for the two intensity conditions. To examine whether changes in self-efficacy reciprocated the changes in state anxiety across exercise-intensity conditions, change scores (pre-post, post-after, pre-after) between self-efficacy and state anxiety were correlated (Baron & Kenny, 1986). To explore moderator variables, first, potential moderators were correlated with state anxiety and significant associations were noted. The significant variable found to have a correlation with state anxiety was run with repeated measures ANOVA median split on the moderator variable. Pre-exercise state anxiety levels were also median split and run with repeated measures ANOVA on the basis of statistical and theoretical logic.

A Check of Methodology

To confirm randomization of exercise intensity days, a 2 (day) x 3 (time) repeated measures analysis of covariance for state anxiety and self-efficacy variables was calculated.

RESULTS

SAI Item Check

Results showed all items behaved similarly to item means, with the exception of item 6. Item 6 increased in score immediately following exercise before decreasing back to pre-exercise levels. All other items displayed a continuous decrease or plateau in values across time. The question for item 6 asked participants to rate their feelings 'right now' with the statement, "I am comfortable". During the experiment, participant complaints regarding the discomfort of the ergometer seat were noted. The increase in score at post-exercise for item 6 is likely due to the physical attribute of the uncomfortable seat itself and not the feeling of "being uncomfortable". However, participants' comments were not formally recorded so suspicions about item 6 are only speculative.

Dependent and Moderator Variables

Table 2 shows average scores for dependent and moderator variables of interest. Chi-square analyses showed no significant difference between groups. One-way ANOVAs revealed no significant results between groups for dependent and potential moderator variables.

Table 2.

Dependent and Moderator Variables for Breast Cancer Survivors Versus Those Without A Cancer Diagnosis

Factors	Cancer Survivor (N = 25)		Without Diagnosis (N = 25)	
	%	SD	M	SD
State Anxiety				
Light Exercise				
Pre-exercise	13.5	3.6	12.7	4.1
Post-exercise	13.0	3.0	12.7	2.9
After-exercise	11.3	.88	10.8	1.0
Moderate Exercise				
Pre-exercise	15.1	4.3	15.0	4.2
Post-exercise	14.3	3.8	13.8	3.5
After-exercise	12.1	2.6	11.8	2.1
Self Efficacy				
Light Exercise				
Pre-exercise	81.1	22.5	87.3	23.9
Post-exercise	89.6	14.9	91.0	16.9
After-exercise	93.6	8.42	93.7	14.1
Moderate Exercise				
Pre-exercise	74.6	22.1	84.1	22.5
Post-exercise	80.1	16.9	87.8	14.7
After-exercise	82.0	16.2	88.5	17.1
Trait Anxiety	34.4	8.8	36.2	9.8
Outcome Expectations	4.39	.42	4.31	.46

Correlations

Table 3 illustrates associations for demographic and potential moderator variables with main variables. For the light exercise condition, trait anxiety significantly correlated with state anxiety post-exercise ($r = .39$, $p < .01$). For the moderate exercise condition, trait anxiety was associated with pre- and after-exercise state anxiety ($r = .41$, $p < .01$; $r = .31$, $p < .05$ respectively).

Table 3

Correlations Between Demographic Variables and State Anxiety

	Age	Education	Marital Status	Employment	Annual Income	TAI	EV	Total LTAQ
State Anxiety								
Light Exercise								
Pre-exercise	-.05	-.04	-.08	.05	-.18	.24	-.01	.11
Post-exercise	.02	.13	-.01	-.07	-.13	.39**	.00	-.02
After-exercise	-.01	.14	.01	-.11	-.11	.29	-.10	-.09
Moderate Exercise								
Pre-exercise	-.10	-.10	-.09	.02	-.04	.41**	.03	-.08
Post-exercise	.07	-.20	-.00	.00	-.17	.25	-.03	-.04
After-exercise	.10	.05	.05	-.06	-.04	.31*	-.03	-.13

* $p < .05$, ** $p < .01$

ANOVA Outcomes for State Anxiety and Self-Efficacy

Test of Assumptions

For state anxiety, Mauchly's test was significant ($p < .05$) for the light exercise condition while Levene's test was significant for the light condition after-exercise measure specifically. For self-efficacy, Mauchly's test showed significance for the moderate exercise condition. To adjust for assumption violations, the Greenhouse Geisser correction was used (Glass & Hopkins, 1996). Type one error was also set at 0.01 in order to provide some experiment-wise error protection.

State Anxiety

For the light exercise condition, 2 (group) x 3 (time) repeated measures ANOVA revealed a main effect for time ($F_{(2, 46)} = 10.09$, $p < .01$, $\eta^2 = .18$) indicating state anxiety significantly decreased across exercise (Table 4). Between group analyses was not significant ($p > .05$) suggesting no difference between cancer survivor and without-diagnosis group. Tukey's post-hoc illustrates significant differences for pre-after and post-after exercise ($p < .01$). Results for moderate exercise are similar to the light exercise condition (Figure 1). A significant main effect for time ($F_{(2, 44)} = 22.34$, $p < .01$, $\eta^2 = .32$) with no significant between group effects ($p > .01$) was found indicating state anxiety decreased across time with no difference between cancer survivor and without-diagnosis group. Moderate intensity had a greater effect size than did the light intensity condition ($\eta^2 = .32$ versus $\eta^2 = .18$). Tukey's post hoc displayed differences for pre-after and post-after exercise ($p < .01$) showing a delayed main anxiolytic effect. These relationships are depicted in Table 4.

Self-Efficacy

Repeated measures ANOVA revealed a main effect for time (light exercise $F_{(2, 41)} = 9.82$, $p < .01$, $\eta^2 = .19$; moderate exercise $F_{(2, 44)} = 4.86$, $p < .01$, $\eta^2 = .10$) with no significant between group effects ($p > .01$) (Table 4). Again, this finding illustrates self-efficacy increased across the exercise bout with no differences observed between cancer survivors and without-diagnosis groups. For both light and moderate intensity conditions, Tukey's post hoc showed significant differences pre-post and pre-after exercise ($p < .01$).

Due to no significant between group effects, breast cancer survivors and without-diagnosis groups were collapsed for remaining analyses in order to improve power.

Table 4.

Main Effects for Exercise, State Anxiety and Self-Efficacy

	Pre-Exercise	Post-Exercise	After-Exercise	P	F	Eta2
State Anxiety						
Light Exercise	13.3	12.8	11.3	< .01	10.1	.18
Post-Hoc:						
Pre-Post Exercise				ns		
Post-After Exercise				< .01		
Pre-After Exercise				< .01		
Moderate Exercise	15.15	14.04	12.08	< .01	22.4	.32
Post-Hoc:						
Pre-Post Exercise				ns		
Post-After Exercise				< .01		
Pre-After Exercise				< .01		
Self Efficacy						
Light Exercise	87.5	92.6	93.6	< .01	9.82	.19
Post Hoc:						
Pre-Post Exercise				< .01		
Post-After Exercise				ns		
Pre-After Exercise				< .01		
Moderate Exercise	79.3	83.9	85.3	< .01	4.86	.10
Post Hoc:						
Pre-Post Exercise				< .01		
Post-After Exercise				ns		
Pre-After Exercise				< .01		

Intensity Differences

T-tests between pre-, post- and after-exercise measures for state anxiety revealed significant differences for all measures ($p < .01$) with the moderate exercise condition experiencing higher levels of state anxiety at all time points (Figure 1). T-tests between intensity change scores showed no significant differences between exercise intensities ($p > .01$), illustrating the anxiolytic effects of exercise were similar across time between intensity conditions. A two-way repeated measures ANOVA confirmed the above results with significant main effects for time across light and moderate conditions ($p < .01$) and no interaction effects ($p > .01$).

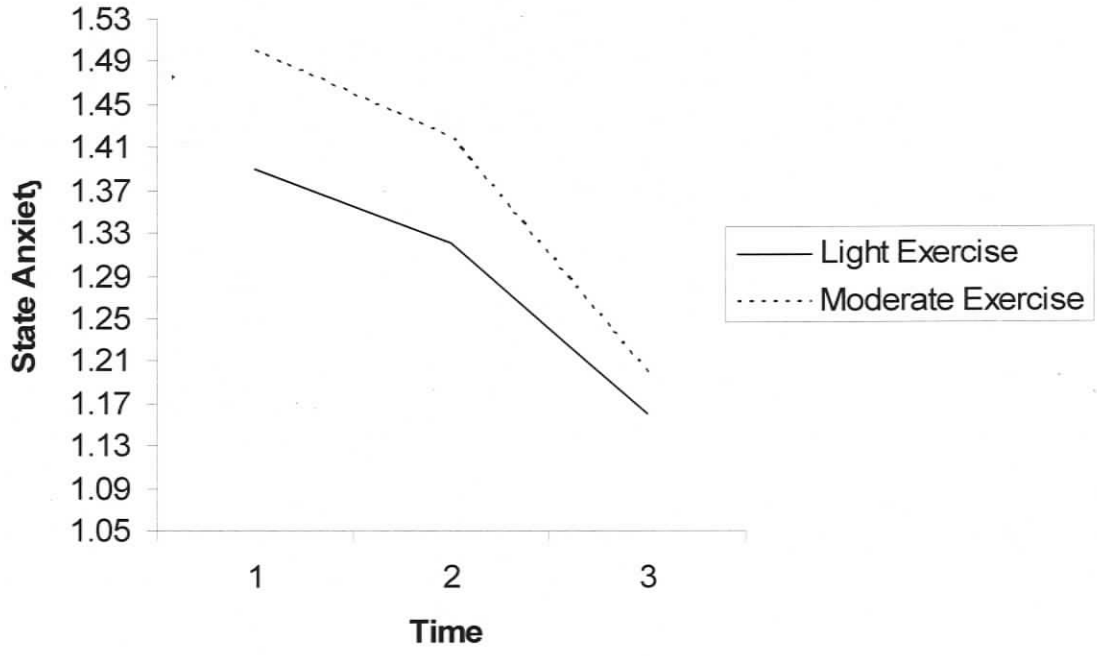

Figure 1. Effects of acute exercise on state anxiety for light and moderate exercise intensity

Reciprocation

Correlations between anxiety and self-efficacy change scores (Table 5) showed significant associations for post-after exercise with the light exercise condition ($r = .50$, $p < .01$) and pre-post exercise for the moderate intensity condition ($r = .29$, $p < .05$).

Table 5.

Correlations between self-efficacy and state anxiety change scores across intensity conditions.

Light Exercise				**Moderate Exercise**			
Change Scores	After-Pre exercise	Post-After exercise	Post-Pre exercise	**Change Scores**	After-Pre exercise	Post-After exercise	Post-Pre exercise
r =	-.24	-.50**	-.19	**r =**	-.20	-.21	-.29*

* $p < .05$, ** $p < .01$

Moderator Variables

To explore whether trait anxiety moderates the relationship with acute exercise and state anxiety, a repeated measures ANOVA with a median split on TAI scores showed significant between group effects (light exercise $F_{(1,43)} = 5.05$, $p < .05$, $\eta^2 = .11$; moderate exercise $F_{(1,44)} = 6.16$, $p < .05$, $\eta^2 = .12$). For both conditions, the high TAI group had greater state anxiety scores and larger reductions in state anxiety change across the exercise bout (Figure 2). The same was seen for pre-exercise state anxiety levels median split with a repeated measures ANOVA (light exercise $F_{(1,45)} = 33.21$, $p < .01$, $\eta^2 = .45$; moderate exercise $F_{(1,46)} = 58.93$, $p < .01$, $\eta^2 = .56$).

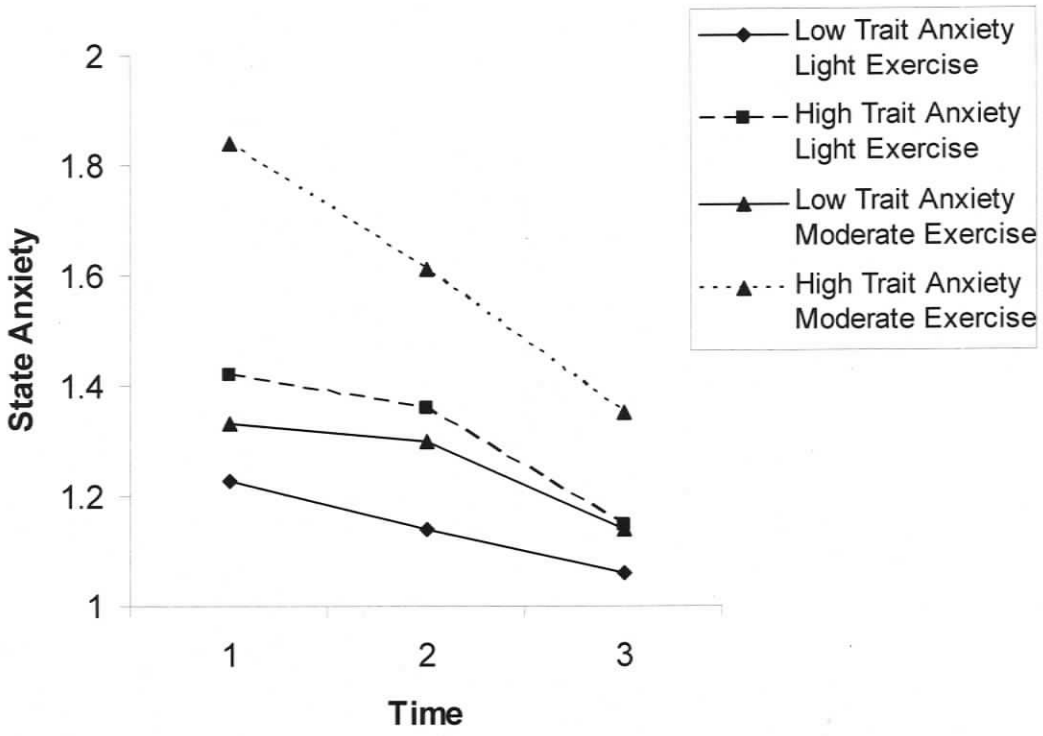

Figure 2. Effects of acute exercise on state anxiety for high/low trait anxiety groups

Randomization Check

Repeated measures ANCOVA confirmed no significant differences between day 1 and day 2 for state anxiety and self-efficacy variables ($p>.05$).

DISCUSSION

Anxiolytic Effects

Results generally support our hypothesis that acute exercise would decrease state anxiety levels both for breast cancer survivors and those without a cancer diagnosis. For both the light and moderate intensity conditions, the main affects of exercise on state anxiety reduction was

large (Cohen, 1977). This finding is similar to that found by Blanchard et al., (2001) who reported moderate-large effects of acute exercise on state anxiety with breast cancer survivors only. However, it was thought that cancer survivors would experience a larger decrease in anxiety over the exercise condition compared to those without a cancer diagnosis (Blanchard et al., 2001; Petruzzello et al., 1991 & Schlicht, 1994). A novel contribution to the literature is that breast cancer survivors and those without a cancer diagnosis appear to react identically to acute exercise. Assuming no medical limitations, an exercise prescription aimed at decreasing anxiety and improving psychological mood need not differ between cancer survivors and women without a cancer experience. This information is useful for health professionals interested in designing exercise prescriptions for those suffering from anxiety. This knowledge is also helpful for those wishing to maximize exercise adherence with patients or participants.

The cancer experience is a unique experience that often comes with many emotional, psychological and physical obstacles. It can not only be distressing for the individual receiving the diagnosis, but also for supportive family members and friends. Participants without a cancer diagnosis who volunteered for the study were often friends or affiliates of participating breast cancer survivors. Family and friends involved in close relationships with breast cancer survivors may be experiencing similar emotions and distress. Therefore, it would seem reasonable to suggest that breast cancer survivors and friends or affiliates might show similar state anxiety scores and reactions to exercise as found in the present study. However, controlling for the impact of all relationships participants have had with individuals who have experienced a cancer diagnosis would prove impractical based on the prevalence of cancer today.

Another novel contribution to the literature concerns the intensities of exercise implemented. Other studies examining the relationship between acute exercise, anxiety and self-

efficacy prescribed light and moderate exercise intensity conditions that were above the intensities used in this study. Selecting the lower half of the recommended intensity ranges for light and moderate exercise was based on the assumption that many breast cancer survivors would be older, not very physically active in the last six months, and likely to possess accompanying illness or disease. Even though large reductions in anxiety were expected for high intensity conditions (Ekkekakis & Petruzzello, 1999) this study showed moderate-large effects with relatively low intensities in a population that scored within normal ranges of pre-exercise state anxiety for those 55-59 years of age. These factors demonstrate the magnitude of impact exercise has on state anxiety, even with light intensity exercise and a population with normal anxiety levels.

An issue to be discussed surrounding the non-significant difference between breast cancer survivors and those without a cancer diagnosis is the impact of baseline anxiety levels between groups. With the current study, there was no significant difference in state anxiety at baseline between groups. This finding is supported by Saleeba, Weitzner and Meyers (1996) and Rothrock et al., (2004) but contradicted by Thomas et al., (1997) in studies not involving exercise. Saleeba, Weitzner and Meyers (1996) and Rothrock et al., (2004) both report state anxiety among breast cancer survivors at levels similar to the general population. Rothrock et al., (2004) suggests that perhaps demographic, psychological, and treatment variables have more of an influence over levels of state anxiety for breast cancer survivors than does the actual diagnosis of cancer. As discussed previously, similarities in experience between breast cancer survivors and those that are emotionallyconnected to them may also play a role.

Differences Between Intensity Conditions

The hypothesized differences in state anxiety pre-post and post-after exercise between intensity conditions was not supported in the present study. According to Bandura's SCT, this finding suggests that both intensity levels were challenging enough for participants to increase self-efficacy, thereby decreasing state anxiety. This finding is congruent with Katula et al. (1999) and Raglin and Wilson (1996) who reported no significant differences in anxiety reductions between light and moderate intensities ($p>.05$). Unexpectedly, state anxiety levels for the moderate exercise intensity condition were higher than the light intensity condition across all three time points. The possible confound of 'first day' effects was ruled out with counter-balanced order of intensities confirmed with a repeated measures ANCOVA. Since participants were aware of the intensity they were going to be asked to exercise at before completion of the first state anxiety and self-efficacy questionnaire, it is possible that the moderate intensity condition shaped greater amounts of 'test' anxiety than did the light exercise condition among participants resulting in the effects observed.

Delayed Effects

The major decrease in state anxiety occurred post-after exercise for both intensity conditions (Table 3; Figure 1). This delayed reduction in state anxiety post-exercise is consistent with the literature (Cox, Thomas, & Davies, 2000; Cox et al., 2004; Ekkekasis & Petruzzello, 1999; Raglin & Wilson, 1996). Theoretically, this finding also provides evidence for the ability of both anxiety and exercise to activate the autonomic nervous system. Only after the physical response to exercise subsides, participants can decipher a reduction in anxiety (Ekkekakis, Hall & Petruzzello, 1999).

Self-Efficacy Reciprocation

In general, the results show some support for self-efficacy and state anxiety reciprocation as described by SCT, although, stronger evidence was expected. An increase in self-efficacy resulted in a more favourable response to exercise as growing confidence over the exercise bout transferred back into a reduction in anxiety (Bandura, 1986). Mastery experience appears to be an effective source of self-efficacy as predicted by Bandura (1986). However, caution must be taken when interpreting results. It is not certain the observed decrease in anxiety and increase in self-efficacy occurred due to mastery of the exercise bout. A change in state anxiety could also be the effect of time, or participant feelings of mastery over the completed testing session. Support for the observed increase in self-efficacy due to mastery of the exercise session and not mastery of the study itself includes variability across participants in levels of self-efficacy and state anxiety change, results following the pattern predicted by SCT, and the change in self-efficacy measured by an exercise-specific scale. In addition, a review by Petruzzello et al., (1999) reports no evidence that anxiety simply increases just before exercise in the presence of a potential threat and then decreases to normal levels upon completion of the activity. However, there is not strong evidence to argue against the possibility that anxiety levels change in part, due to factors other than mastery of the exercise bout. Based on the results of this study only, recommendations for increasing self-efficacy would involve both an opportunity for mastery of a task, but also a chance for mastery of an anticipated event. Planning the experience in advance to allow time for individuals to contemplate and anticipate the experience could help strengthen self-efficacy, which in turn could affect state anxiety.

Stronger statistical evidence for self-efficacy and anxiety reciprocation was expected from the current results (Katula et al., 1999; Marquez et al., 2002). Reasons for only a couple

significant self-efficacy reciprocation findings include ceiling and floor effects for both self-efficacy and state anxiety respectively. In addition, small change scores for both self-efficacy and state-anxiety were observed making significant correlations difficult to detect.

Moderators of Anxiety-Exercise Relationship

A key finding in this study was the moderating impact of trait-anxiety on state anxiety in the exercise domain. It appears personality may have a moderate-large influence over acute exercise and state anxiety reduction (Cohen 1977). This finding, although exploratory in design, was expected. The literature surrounding trait anxiety and coping with cancer is in strong support of the notion that those with higher state anxiety have more complications and worries associated with the inability to cope (Cameron, Leventhal & Love, 1998; Thomas et al., 1997). In both exercise intensity conditions, those in the high TAI group started the exercise bout with higher state anxiety and experienced a greater state anxiety reduction across the exercise bout (Figure 2). In other words, those with a predisposition for anxiety in exercise environments showed the greatest reduction in state anxiety across exercise. This finding is supported by the study by Motl et al., (2004) who reported larger reductions in anxiety for men having high trait anxiety.

In addition to trait anxiety, pre-exercise anxiety moderated the exercise-state anxiety relationship with the higher pre-exercise anxiety group showing the greatest reductions over the exercise bout. Effect sizes were very large (Cohen, 1977). This result is also to be expected given that those who suffer the most from anxiety, have the most to gain from the anxiolytic effects of exercise.

Initial Values

The proposed ceiling and floor effects help explain the violations in homogeneity of variance for both state anxiety and self-efficacy. Despite the self-reported mood state with which

participants began the experiment, in general, they left with low levels of state anxiety and high levels of self-efficacy. Perhaps a study involving participants less fit and thus, less confident in their physical activity abilities would yield more significant effects (Landers and Petruzzello, 1994). This note is also confirmed by the sample's high levels of physical activity and outcome expectations observed in the population demographics.

Limitations

Limitations of the study are as follows. First, the repeated use of the SAI and SEQ questionnaires may have posed some test burden on respondents. The transparent nature of the self-report questionnaires may have caused some respondents to answer favourably and thus providing an overestimation of the true relationships examined. However, participants were never explicitly told the hypotheses or dependent variables of interest and did not know the intensity of exercise bout until arrival at the lab for each session. The repeated use of the SAI and TAI has been employed by other studies investigating exercise, anxiety and self-efficacy (Butki, et al., 2001; Katula et al., 1999; Marquez, et al., 2002; Petruzzello et al., 1991). Second, the scales used to measure potential differences in state anxiety and self-efficacy across an exercise bout have not been validated to measure change explicitly. Therefore, we are assuming change detected in the scale reflects changes in anxiety and self-efficacy due to the exercise bout and not because of the construct itself. Third, a study involving exercise inherently attracts physical activity advocates, thus biasing the results towards activity and perhaps contributing to the proposed ceiling effect in exercise self-efficacy. Fourth, a treatment variable measured in the present study that may have influenced pre-exercise anxiety levels among cancer survivors is time since treatment completion. Although this variable was not found to influence anxiety levels among breast cancer survivors in the study by Rothrock et al., (2004), it is proposed that this

factor may have played a role in the levels of state anxiety experienced by breast cancer survivors in the present study. Time since treatment completion was not limited in eligibility criteria and variability across participants was large. The majority of breast cancer participants were long-term survivors and thus, thoughts and feelings of apprehension may have been more like that of the without-diagnosis group than a recent breast cancer survivor. Fifth, psychological illness or disease was not controlled for. Illnesses such as depression or other forms of anxiety could have influenced results and this must be considered with interpretation of findings.

Conclusion

Exercise at moderate and light intensities may provide an effective, economic, and readily available strategy to those suffering from anxiety, breast cancer survivors and women without a cancer diagnosis alike. However, this relationship appears to be dependent on individual personality and pre-exercise state anxiety. Building self-efficacy through exercise may be the key to reductions in anxiety after exercise. From a public health perspective, exercise programs focused on building confidence, enjoyment and positive affect will maximize adherence and consequently provide opportunity for the mirage of health benefits associated with regular physical activity. Future research in this area should focus on subpopulations known to possess high levels of anxiety and poor exercise self-efficacy to avoid ceiling and floor effects. In addition, controlling for mental illness among participants, time since cancer diagnosis and the number of diagnoses (whether it be different cancers or a recurrence of the same type of cancer), would be valuable investigations into the breast cancer experience as it relates to anxiety both at baseline and in response to exercise.

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CHAPTER 2:

BACKGROUND LITERATURE

The following review of literature will focus on four topics. The first section will discuss the literature to date regarding breast cancer, anxiety and the proposed prevalence of anxiety among cancer survivors. The second section will examine anxiety, exercise and breast cancer, addressing the need to investigate acute exercise with breast cancer survivors and the general population comparatively. The third section will emphasize the connection between exercise intensity, anxiety and self-efficacy predicted by social cognitive theory. Lastly, the fourth section will describe studies that have examined the acute exercise intensity-anxiety relationship and identify physical activity history, trait anxiety, outcome expectations and pre-exercise anxiety levels as potential moderating variables. A rational concerning exercise dose and timing of measurements will also be provided.

Anxiety and the Cancer Experience

Breast cancer is the most common cancer diagnosis in women (Canadian Cancer Statistics, 2007). Due to advancement in detection, a growing population and effective treatment methods breast cancer survivorship has increased. There is an estimated 162,000 individuals in Canada living with a breast cancer diagnosis, and this number is expected to rise (Canadian Cancer Statistics, 2007). Therefore, recent research has focused on many of the physical and psychological challenges preventing an optimal quality of life that extend beyond just recovery of the cancer itself.

There are many definitions, types and theories of anxiety. Anxiety may be defined according to the stimulus (i.e. social anxiety or test anxiety) or the presenting symptoms (moment-to-moment or chronic). As a psychological construct, anxiety is a hypothetical entity which may or may not posses a physical component (Levitt, 1967). For example, someone who is anxious may experience an increased heart rate and production sweat, or they may not. Webster's dictionary (1956) defines anxiety as a painful uneasiness of mind or an impending or anticipated ill event. Likewise, the American Psychiatric Association (1952) describes anxiety as a danger signal felt and perceived by the conscious portion of the personality and produced by a threat from within the personality with or without simulation from external situations. Thus, the threat that is causing feelings of uneasiness could be tangible (i.e. an assaulter) or entirely perceived (i.e. entering a social situation). Bottomley (1998) describes anxiety as an uneasy and unpleasant feeling of potential harm or distress that often occurs in the absence of a physical stimulus. It develops in association with cognitive processes pertaining to the inability to cope and can be divided into two types: state and trait anxiety. State anxiety refers to the moment-to-moment variations in the intensity of an individual's thoughts and feelings of apprehension (Martens, Vealey & Burton, 1990, p9). Trait anxiety is a personality characteristic describing how prone an individual is to experiencing episodes of anxiety (Marten et al., 1990, p9). State anxiety is related to the cancer experience through thoughts and feelings regarding the illness and the future (Bottomley, 1998). For example, Stefanek and colleagues, (1989) found approximately half of cancer survivors averaging 16 months post-diagnosis reported worry as somewhat of a problem. Similarly, Spencer et al., (1999) reported early stage breast cancer patients worry about recurrence, mortality, health and financial circumstance. Small effect sizes ($d = .19$ to $.28$) have been reported for common anxiety-coping interventions, such as educational, informational,

psychotherapeutic, and non-professional social support (Meyer & Mark, 1995). Thus exercise may serve as an additional anxiety-coping strategy among cancer survivors where the need for an effective strategy exists.

Anxiety has been amply reported in response to diagnoses and treatment of cancer (Bottomley, 1997; Fulton, 1999; Newell, Sanson-Fisher, Girgis, & Ackland, 1999; Stefanek, Derogatis & Shaw, 1987), however, the presence of state anxiety among cancer survivors empirically remains inconclusive. Thomas et al., (1997) found long-term cancer survivors commonly suffer high levels of anxiety. These survivors are less willing to be discharged from medical consultations, tend to visit their general practitioners more, and require more overall health care resources than patients without such levels of anxiety. In contrast, Rothrock et al., (2004) reported state anxiety levels of 120 breast cancer survivors at least one year post treatment as lower than general medical patient norms. Likewise, Saleeba, Weitzner and Meyers (1996) reported women without cancer having similar levels of state anxiety to breast cancer survivors averaging 8.5 years post-diagnosis. To compare anxiety, but also the effects of acute exercise on anxiety, breast cancer survivors and a group of age-matched controls without a cancer diagnosis will be the subjects for the present study.

Exercise & Anxiety

In the general population, it has been demonstrated consistently that acute exercise reduces state anxiety (Callaghan, 2004; Motl & Dishman, 2004; Petruzzello et al., 1991; Youngstedt et al., 1998). The effects of regular exercise has also been reported to decrease state anxiety among cancer survivors (Segar et al, 1998). Segar et al. (1998) described a 25% decrease in anxiety for breast cancer survivors (n = 24) averaging 41.8 months post-surgery who

exercised aerobically for 10-weeks compared to an 11% increase in anxiety for the control condition.

One study examining the effects of regular exercise with bone marrow transplant patients, encouraged 25 patients to engage in physical activity (either walking around the treatment centre or cycling on provided ergometers) following high dose chemotherapy and autologous bone marrow transplantation (Courneya et al., 2000). Exercise during hospitalization showed significant correlations with reduced anxiety for minutes cycled per day ($r = 0.54$, $p < .01$) and combined cycling/walking minutes per day ($r = 0.36$, $p < .05$). However, perhaps of more relevance to the present study is the reported 40% of the total participants measured that did not cycle at all during the study while 24% abstained from exercise all together. In addition, the mean duration of walking/cycling combined per day in the present study was less than 8 minutes which, according to the American College of Sports Medicine (ACSM) guidelines for maintaining and developing cardio-respiratory and muscular fitness, does not meet the recommended minimum of 20 minutes per day (ASCM, 1998). Courneya et al. (2000) suggested that more structured interventions beyond simple encouragement are needed to promote exercise. Therefore, exploring the effects of exercise intensity on anxiety with breast cancer survivors may improve the effectiveness of current exercise prescriptions by providing evidence for the optimal exercise intensity aimed at relieving anxiety and increasing adherence.

Studies examining the habitual effects of exercise are important. However, unlike the studies examining acute effects of exercise, they are limited in their ability to explain the underlying mechanisms involved with exercise and psychological functioning (McAuley et al., 1999).

The effect of acute exercise on anxiety among breast cancer survivors has been reported in one study. Blanchard et al., (2001) found a decrease in state anxiety for those breast cancer survivors with high pre-exercise anxiety levels after engaging in a 12-minute graded exercise test on a cycle ergometer (Blanchard et al., 2001). A larger effect size (d = 0.70) than effect sizes (d = 0.23, and 0.15) reported in meta-analyses (Petruzzello et al., 1991; Schlicht, 1994 respectively) concerning the general population was reported by Blanchard et al., (2001). The limitations identified by Blanchard et al., (2001) included lack of compare group and lack of separate intensity conditions. More research following the preliminary investigation by Blanchard et al., (2001) is warranted. The current study will replicate and expand on the work of Blanchard et al. (2001) by incorporating a without cancer diagnosis group, and two different exercise intensity groups.

Self-Efficacy & Bandura's Social Cognitive Theory

A well-known theory occupying the psycho-social literature and gaining popularity in the exercise intensity and anxiety literature is Bandura's social cognitive theory (1986). The social cognitive theory (SCT) describes how an individual's behaviour, cognition, and environmental influences all interact to predict and explain behaviour.

The model of triadic reciprocal causation, depicted in Figure 1. below, illustrates the connection between one's behaviour, their environment and their personal attributes such that each determinant affects and is affected by other determinants. Thus, a person may be affected by both their environment and their behaviour, while their own thoughts and attitudes affect their environment and behaviours. Bandura (1986) explains, "People shape their environment by their

own self-regulated actions and environmental influences in turn, affect the operation of self" (p. 369).

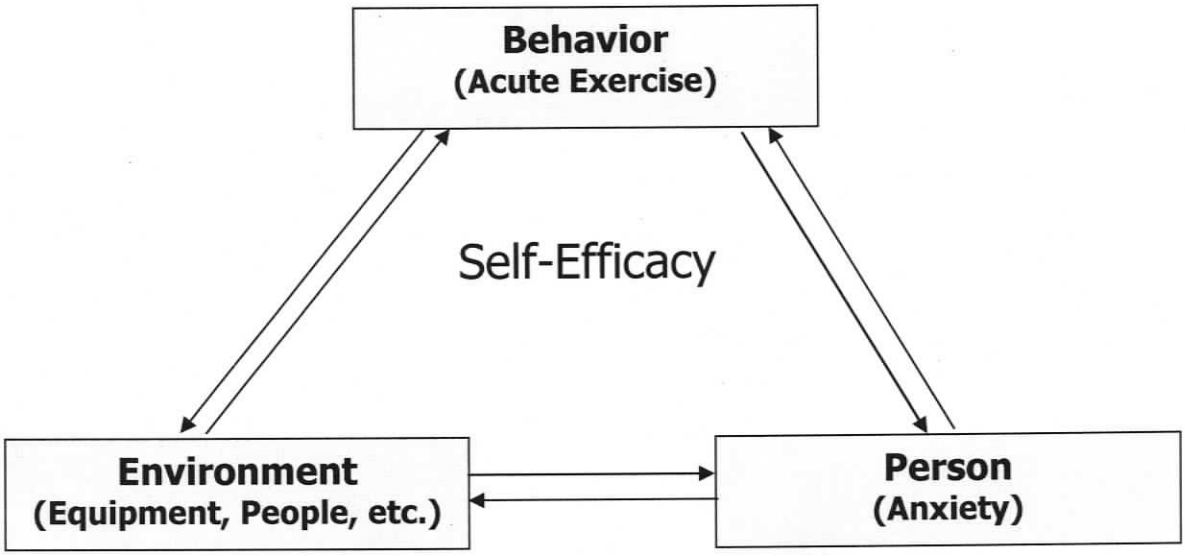

Figure 3. Triadic reciprocal causation model of social cognitive theory (Bandura, 1997)

At the foundation of the SCT lies self-efficacy. Bandura (1977) defines perceived self-efficacy as one's belief about their capability to successfully engage in a behaviour to produce a desired outcome. Self-efficacy can also refer to general or specific behaviours. In the physical activity domain, exercise efficacy refers to one's beliefs about the capability to successfully engage in incremental bouts of specific or general physical activity. Many issues surrounding exercise prescription and adherence are influenced by self-efficacy.

There are four major sources of self-efficacy. These include mastery experience, observational learning, social persuasion and emotional and somatic states. Bandura (1997) describes mastery experience as the strongest source of self-efficacy. Bandura (1997) further describes the importance or using tasks that are optimally challenging yet require a level of sustained effort to complete in order to most effectively build a resilient self-efficacy. For

individuals facing a cancer recovery, completing a physically challenging but realistically attainable task may provide a sense of control to those that may otherwise feel they don't have any. This physical challenge may also serve to increase the likelihood of that behaviour occurring again.

Observational learning is the experience of shaping personal self-efficacy beliefs regarding a particular behaviour and is based on the success and failures of others. Social persuasion is the verbal or situational influence of others that may serve to enhance or diminish self-efficacy. Somatic cues, such as increased heart rate, increased sweating, and increased respiration rate can also provide a signal to the individual about his or her physical capabilities. In addition, a positive mood can serve to enhance efficacy, while a negative mood can serve to decrease it (Bandura, 1998). Observational learning, social persuasion and somatic cues will not be employed as sources of self-efficacy in the present study. However, somatic cues will be present, but will be used to adjust the intensity of exercise for each individual.

Consistent with Bandura's reciprocal causation model, efficacy not only acts in its' own right, but also acts on the determinants of how one thinks, feels and acts. Because mastery experience is the strongest contributor to self-efficacy, overcoming a physically challenging task may serve to increase mood and outcome expectancies toward the specific task, which in turn, acts to further increase self-efficacy. Thus, self-efficacy expectations will determine subjective states such that a stronger sense of exercise self-efficacy results in more favourable responses to exercise and that these favourable responses will serve to further boost future self-efficacy (Bandura, 1997). Individuals with high self-efficacy expectations tend to approach more challenging tasks, expend more effort, and persist longer in the face of adversity. When faced

with stressful situations, low efficacious individuals tend to give up, attribute failure internally and experience greater psychological distress.

SCT offers insight and options into how to influence physical activity adoption and adherence. Whether it is health promotion campaigns or exercise programs, SCT takes a broad perspective on the dynamic interactions that occur with a person's thoughts, feelings, actions and surroundings and provides avenues through which these interactions can be influenced.

Empirical Support

Studies examining self-efficacy and anxiety response to exercise have reported some support for SCT (Butki, Rudolph & Jacobsen, 2001; Katula et al., 1999; Marquez, Jerome, McAuley, Snook, Canaklisova, 2002). Marquez et al. (2002) examined self-efficacy as a moderator of anxiety responses following acute exercise by manipulating self-efficacy and measuring anxiety responses both before and after exercise in a sample of low-active women ($n = 59$). According to Marquez et al. (2002), compared to participants reporting low self-efficacy, participants reporting high efficacy reported lower anxiety ($p < .01$) both before and after exercise. Both conditions demonstrated significantly lower anxiety scores 20-minutes post-exercise ($p < .001$). Marquez et al.'s (2002) study supports the notion that those with high self-efficacy have less anxiety post-exercise.

In an earlier study, Katula et al., (1999) measured the change in self-efficacy in 80 older adults as it related to reductions in anxiety following exercise at light and moderate intensity. Findings revealed that although anxiety was significantly reduced for the light and moderate conditions, changes in self-efficacy mediated anxiety responses only in the moderate intensity condition. This finding supports the mechanism of source for self-efficacy explained by the SCT as Bandura (1986) suggests how self-efficacy exerts its greatest influence in sufficiently

challenging situations. Katula et al.'s finding also supports the reciprocal relationship between self-efficacy and anxiety. Efficacy influences affective responses that in turn, affect subsequent efficacy (Bandura, 1986).

Butki, Rudoph and Jacobsen (2001) examined self-efficacy and anxiety with 12 physically active males running for 20 minutes at 85% maximal heart rate on the treadmill. Butki et al. (2001) report no significant correlation between changes in anxiety and self-efficacy. An exercise session that was not physically challenging enough for this sample to elicit changes in self-efficacy was suggested by Butki et al. (2001) as an explanation for the unexpected results. They advised future research to involve low active participants.

The present study will include an adapted version of a validated self-efficacy measure (Katula et al., 1999; Tressure & Newberry, 1998) to determine change in self-efficacy over an exercise period of moderate or light intensity. Consistent with the empirical findings and Bandura's SCT, it is expected that self-efficacy will reciprocate decreases in state anxiety across exercise at intensities that are optimally challenging for the individual and the mastery experience.

Acute Exercise and Anxiety: Alternative Theories

The theory used to be used in the present study relies on the assumption that state anxiety and trait anxiety are unidimensional constructs. An alternative theory describes trait and state anxiety as multidimensional constructs (Endler, Parker, Bagby, & Cox, 1991). The interaction model of anxiety predicts the greatest state anxiety changes across exercise will be observed for those individuals who posses high exercise trait anxiety (Blanchard et al., 2002; Endler et al., 1991). In addition to this purely psychological alternative theory, many other psychological theories related to exercise and anxiety that have their basis in biological mechanisms. For

example, the endorphin hypothesis suggests that endorphins, a chemical that is similar in structure to morphine, is released during exercise and is responsible for the euphoric feelings experienced after exercise (Christie & Chesher, 1982). The monoamine hypothesis discusses how exercise can cause an increase in activity of neurotransmitters such as dopamine, epinephrine and serotonin that interact and improve mood states (Brown, Payne, Kin, Moore & Martin, 1979). The opponent-process hypothesis suggested that the aroused state created by exercise is countered by the body with an increase in parasympathetic functions in order to maintain homeostasis. An increase in parasympathetic functions in the body in turn causes heightened feelings of positive and relaxed valence (Solomon, 1980). In light of findings, these alternative theories may be considered.

Exercise Intensity

Exercise intensity and anxiety reduction is the area of greatest ambiguity in past reviews (Petruzzello et al., 1991; Landers & Petruzzello, 1994). More recent studies have attempted to explain the inconsistency across studies by pointing to the lack of theoretical frameworks and moderating variables that may influence the relationship between exercise intensity and anxiety (Katula et al., 1999; Motl et al., 2004; Tieman et al., 2002).

Cox et al. (2004) recently measured state anxiety before, immediately after, and 30, 60, and 90 minutes post-exercise in 24 active women exercising for 20 minutes at 60% or 80% VO2max. All three conditions (including control) significantly decreased ($p < 0.05$) state anxiety scores pre- to post-exercise, with the 80% condition showing the largest decline. Similarly, Raglin and Wilson (1996) tested 15 young healthy males at 40, 60 and 70% VO2peak after 20 minutes of cycling and found all intensities equally effective at reducing ($p < 0.05$) state anxiety.

However, the reduction was delayed for the high intensity condition. Conversely, in a study involving 30 male undergraduate students, Tieman et al. (2002) reported a reduction ($p = 0.03$) in state anxiety among those participants categorized as low active after cycling at 40% VO2peak for 20 minutes which represented an effect of approximately one-half standard deviation. No significant change in state anxiety was observed for the high intensity (75%VO2max) group for either low or high active categories.

Tieman et al. (2002) suggests that the search for a dose-dependent gradient seems too simplistic without considering additional moderating variables. However, the trait anxiety, outcome expectation and physical activity history variables controlled by Tieman et al.'s (2002) study were not included in Cox et al.'s (2004) or Raglin and Wilson 's (1996) study, which may have contributed to the inconsistent results.

Moderating Variables

As mentioned, moderators such as trait anxiety, baseline anxiety levels, physical activity history and outcome expectations have been identified within the literature as influencing the relationship between acute exercise and anxiety. Trait anxiety has been controlled for in two studies examining the effects of acute exercise on state anxiety (Tieman et al., 2002; Motl et al., 2004). In a study by Tieman et al. (2002), controlling for trait anxiety strengthened the anxiety-reducing effect of exercise at 40% VO2max ($p = .017$), but did not influence the results for the 75% VO2max condition. Similar results were found by Motl et al. (2004), when examining the effects of quiet rest, light- and strenuous-intensity cycling on state anxiety among men with low or high trait anxiety. These researchers found a reduction in state anxiety between quiet rest and exercise, with the largest reduction in anxiety reported for men with high trait anxiety.

Theoretically, it seems logical to suggest that those generally more prone to experience higher levels of anxiety (trait anxiety) may be more likely to experience greater changes in levels of moment to moment anxiety before and after exercise (state anxiety). This study assumes that both trait and state anxiety are unidimensional constructs. Thus, to make sure the change in state anxiety is due to the intervention itself and not the predisposition of the individual, trait anxiety must be controlled.

The unidimensional theory used in the present study of anxiety is not the only theoretical model to exist. In a study investigating a multifaceted interaction model of anxiety, a community sample (n = 44) was assessed before and after a maximal exercise test. An evaluative questionnaire that considers both state and trait anxiety constructs as multidimensional was used (Blanchard, Rodgers, Bell, Wilson & Gesell, 2002). Based on this model, a maximal exercise test posing a threat to those generally more anxious (high trait anxiety) in physical situations would be expected to show the greatest change in state anxiety in absence and then presence of the threatening stimuli (Endler, Parker, Bagby & Cox, 1991). In addition, those individuals who did not posses high trait anxiety for physically threatening situations but perhaps showed high trait anxiety for other dimensions, such as daily routine or social evaluation, would not show a reflective change in state anxiety in the presence and absence of a physical threat. This hypothesis was supported in Blanchard et al.,'s (2002) study. The multidimensional scale consists of 80 items and is too long for the immediacy required from state anxiety measures. However the multidimensional model and theory will be considered in light of null findings.

Among cancer survivors, baseline levels of anxiety have recently been reported to moderate the anxiolytic effects of acute exercise (Blanchard et al., 2001). Blanchard et al.'s

finding is consistent with previous literature concerning the general population (Breus & O'Connor, 1998; Focht, 2002; Landers & Petruzzello, 1994; Youngstedt et al., 1998).

Exercise history and or fitness levels have also been examined as moderating variables between intensity and anxiety responses (Dishman, Farquhar, & Cureton, 1994; Landers & Petruzzello, 1994; Steptoe, Kearsley & Walters, 1993; Tieman et al., 2002). However, findings have been equivocal. Landers and Petruzzello (1994) found that regardless of exercise intensity, there was a greater reduction in anxiety among low-fit individuals compared to high-fit individuals. Landers and Petruzzello (1994) suggest that similar to participants with high pre-exercise anxiety levels, participants less physically active have the greatest exercise anxiety-improvement potential. Similarly, Tieman et al. (2002) reported a reduction in anxiety ($p = .003$) for the low active group after light cycling and no significant decrease for the high active group. However, Steptoe et al. (1993) investigated mood responses with inactive and active men and found no differences reported between the inactive and active men for the moderate (50% VO2) and high intensity (70% VO2) exercise conditions. In addition, Dishman et al. (1994) found that although men did not differ in perceived exertion or blood lactate levels, the active participants reported a significant reduction in state anxiety immediately after cycling ($p < .001$) while anxiety was unchanged in the low active participants.

Tieman et al. (2002) argue the studies which found reductions in anxiety for the highly active groups observed reductions due to self-fulfilling expectations about the psychological benefits of exercise rather than due to the interventions themselves. Hsiao and Thayer (1998) and Steinhardt and Dishman (1989) support this self-fulfilling argument by describing high active individuals as more likely to expect added psychological benefits from engaging in exercise than

low active individuals. Furthermore, most studies examining anxiety levels use self-report questionnaires that are sensitive to individual perceptions and expectations.

Bandura (1998) speaks of outcome expectations as a component of the social cognitive theory. He explains how an individual that possesses a strong belief about the ability to perform a certain physical activity (self-efficacy) and believes that this physical activity will lead to desired outcomes (outcome expectation), will be more likely to engage in the activity and report positively about it (Bandura, 1998). According to Bandura (1998), outcome expectations can take three forms; physical, social and self-evaluative. Physical outcomes include sensory experiences such as pain, discomfort or pleasure. Social outcomes are things such as others approval, admiration or disgust. Self-evaluative outcomes describe one's personal standards that determine self-satisfaction or self-dissatisfaction. Within each form, positive outcomes serve as incentives to perform the behaviour and negative outcomes serve to diminish the likelihood of performing the behaviour.

In the current study, to control for confounding effects of both physical activity history and outcomes expectations, both will be included as pre-exercise questionnaires and explored as possible moderators to the exercise-anxiety relationship.

Delayed Effects

Reductions in state anxiety are not always observed immediately following an acute bout of aerobic exercise. Often, higher intensity exercise conditions require more recovery time before a drop in anxiety is observable (Cox, Thomas & Davis, 2000; Cox et al., 2004; Raglin and Wilson, 1996). Cox et al. (2000) tested participants at 50% and 75% estimated VO2max on a treadmill or step machine and found both intensities significantly decreased anxiety. However, reductions were apparent for the higher intensity condition after 30 and 60 minutes post-exercise

($p < .02$) but were not seen for the lower exercise intensity condition. Similarly, Cox et al. (2004) tested participants immediately after, 30, 60 and 90 minutes following a 20 minute bout of exercise at either 60% or 80%VO2max. Differences between intensity groups were apparent at 30 minutes post-exercise for the 80% condition only ($p < .05$) (Cox et al., 2004). Furthermore, Raglin and Wilson (1996) tested participants at 40, 60 or 70%VO2 following 20 minutes on a cycle ergometer and significant reductions in anxiety were seen for all conditions ($p < .05$) but was delayed for the 70%VO2 condition.

Consistent with the above studies, Ekkekasis and Petruzzello (1999) conclude that both the intensity of exercise stimulus and the time of assessment may influence state anxiety scores. Considering the added physiological and psychological challenges the potential participants of the present study may be facing, state anxiety will be assessed immediately following exercise and 10 minutes post-exercise. Heart rate at the time of the final anxiety measurement will be recorded.

Exercise Dose

Selected intensities for "light" and "moderate" have varied across studies (Berger & Owen, 1998; Kerr & Kuk, 2001; Cox et al., 2000; Cox et al., 2004; Ekkekasis & Petruzzello, 1999). For developing and maintaining cardio-respiratory and muscular fitness, the ACSM (1998) suggests a minimum duration of 20 minutes exercising at an intensity of 40% - 90% of maximum heart rate reserve. The lower intensities given within the range are suited towards individuals who are unfit. However, these levels of activity have not been studied or tested specifically in breast cancer survivors. Therefore, the American Cancer Society recommends that any movement is likely beneficial for cancer survivors and should be encouraged (Brown et al.,

2003). Considering the population involved in the present study, it seems logical to establish intensity ranges suited for participants who have little physical activity history, who may have decreased physical activity levels since diagnoses or who may have additional illness or disease. Reduced levels of fitness, stamina, and strength combined with the distress that accompanies a cancer diagnoses, treatment and recovery challenge cancer survivors who want to be active. Therefore, the light and moderate intensity conditions will be set at 30-35% heart rate reserve and 60-65% heart rate reserve, respectively. These intensities are congruent with the recommendations made by Schneider, Dennehy and Carter (2003) for exercise prescriptions specifically for the cancer population and with the American Cancer Society's guide (Brown et al., 2003).

The duration of 20 minutes for the acute exercise bout is consistent with the minimum duration of exercise recommended by the ACSM (1998), and with Petruzzello et al. (1991), who reported that acute exercise under 20 minutes versus 21-30 minutes was equally effective at reducing state anxiety.

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Appendix A

OPERATIONAL DEFINITIONS

State Anxiety

Feelings of distress and apprehension an individual feels at a particular moment, as measured by the State-Anxiety Inventory (SAI), a 10-item self-report questionnaire (Speilberger, Gorsuch, Lushene, Vagg & Jacobs, 1983).

Trait Anxiety

An individual's general predisposition to respond with high levels of anxiety, as measured by the trait scale of the State-Trait-Anxiety Inventory (TAI), a 20-item self-report questionnaire (Speilberger et al.,1983).

Acute Exercise

A one-time bout of aerobic exercise lasting 20 minutes, measured on a Monark M676 cycle ergometer.

Cancer Survivor

A person who has been diagnosed with cancer (NCCS, 2005) who has personally consented and has been given permission from their general practitioners to engage in two bouts of light and moderate aerobic exercise.

Activity History

The predicted fitness of participants based on physical activity levels, as assessed by the Leisure-Time Exercise Questionnaire (Godin, Joblin & Bouillon, 1986; Godin & Shephard, 1985).

Light Intensity

Cycling at 30-35% age-predicted heart rate reserve, as determined by Karvonen's predictive equation: Target HR = [(220-age) – HRrest] x %exercise intensity + HRrest (Heyward, 2002).

Moderate Intensity

Cycling at 60-65% age-predicted heart rate reserve, as determined by Karvonen's predictive equation: Target HR = [(220-age) – HRrest] x %exercise intensity + HRrest (Heyward, 2002).

Appendix B

ASSUMPTIONS

1. Anxiety, self-efficacy, physical activity history and outcome expectations can be accurately measured with a self-report questionnaire
2. Participants answer all questions accurately and honestly

LIMITATIONS

1. A population of breast cancer patients may not be generalizable to all cancer groups or the general population
2. Participants will not be randomly selected, but chosen based on their cancer status and geographic location. Therefore, the sample may not be representative of a larger population.
3. Self-report measures may not be completely accurate.
4. Participants may not answer all questions and measures accurately and honestly.
5. The repeated use of SAI and SE questionnaires may pose some test burden and risk of memory transference at each administration point rather than the participants evaluating their psychological state separately for each time they are asked to complete the questionnaire.

DELIMITATIONS

1. Participants must be physically healthy enough to engage in a bout of low or moderate intensity exercise as determined by their physicians' approval and the Physical Activity Readiness Questionnaire (Par-Q).
2. Participants must be at least 19 years of age.
3. Participants must have been diagnosed with breast cancer and have completed treatment.

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Coping? Quality of Life? Exercise?

Help… Seeking Cancer and Non-Cancer Volunteers!!

A study involving **exercise**, **quality of life** and **cancer survivors** is being conducted at the University of Victoria, Behavioural Medicine Laboratory. We are looking for **breast cancer survivors** who have completed treatment and **non-cancer participants** for the control group**.** Volunteers must be willing/able to participate in two separate 20-minute bouts of light and moderate intensity **exercise** (cycling on a stationary bike). You will be asked to fill out a few questionnaires before and after cycling regarding your physical activity history, demographic/medical information, expectation, current psychological well-being, and confidence in cycling for different amounts of time. You do not need to be currently active to participate! Medical clearance from your doctor (GP) will also be required (Cancer survivors only). Participants will be tested on an individual basis unless requested otherwise. Of course, you may stop exercising or refuse to answer certain questions at any time. Parking at the University and cost of obtaining physician approval will be reimbursed if required. A 50$ honorarium will be given in appreciation. Confidentiality is ensured.

If interested, please contact **Rachel Blacklock (250) 881-6169 / rachelb@uvic.ca** for further information. In addition you may verify the ethical approval of this study, or may raise any concerns you might have by contacting the Associate Vice President, Research at the University of Victoria (250) 472-4362.

Appendix D

Behavioural Medicine Laboratory UVic

Notice of Research Study & Informed Consent

My name is Rachel Blacklock and I am a Graduate student in the School of Physical Education at the University of Victoria. I am currently working under the supervision of Dr.Ryan Rhodes (associate professor and director of the Behavioural Medicine Laboratory at the University of Victoria). As part of my Master's degree fulfillment, I will be conducting a study in the area of cancer, exercise and quality of life. You have received this research package because you are interested in participating in my study and I invite you to do so.

Previous research has shown that exercise benefits breast cancer survivors. Physical activity may provide an empowering and effective coping strategy for those suffering from a compromised quality of life. In this study, we are trying to examine whether exercise may influence psychological well-being. This information will be very helpful in designing specific exercise prescriptions for breast cancer survivors and in recommending exercise as a complementary coping strategy to individuals.

The Behavioural Medicine Laboratory support the practice and protection of human subjects participating in research. The following information will help you to decide whether you wish to volunteer to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without affecting your opportunity to participate in other studies or events.

This study will take place at the University of Victoria, Behavioural Medicine Laboratory and participants will be tested on an individual basis unless requested otherwise (it is possible to be tested at the same time as a friend or family member). Participants will be asked to attend two testing sessions at the University to cycle on a stationary bicycle for 20 minutes per session. A few questionnaires will need to be filled out before and after each exercise bout. Heart rate will be monitored throughout the exercise and you will be asked about your perceived level of exertion. Questionnaires to be completed at the laboratory ask questions regarding current psychological well-being, expectation, and confidence in cycling for different amounts of time. Forms to be completed before you reach the laboratory include a participant profile (including medical, demographic and physical activity questions), participant consent form (this sheet), a physical activity readiness questionnaire, and a medical clearance form requiring a signature from your general physician (breast cancer survivors only). Participation in this study will require approximately 4 hours of your time total. The tests at the laboratory should take no more than $1^{1/2}$ hours each and a visit to your general physician to obtain approval is estimated to take 1 hour.

Once the tests are complete, results from all participants will be tabulated and summarized. The obtained data may be used in reports and publications, but your identity will not be associated with such reports. The expected individual benefits associated with your participation include information regarding your level of physical fitness and how a one-time bout of exercise affected your psychological well-being. Participation will benefit breast cancer survivors in general by helping researchers, oncologists and healthcare staff better understand exercise as an effective coping strategy.

Inconveniences associated with participating in this study include the time and effort involved in obtaining physician approval, answering the questionnaires and engaging in two bouts of exercise. In addition, some of the psychological well-being questions asked may prompt self-reflection that otherwise would not have been thought of. As a result of the light and moderate cycling, some muscle soreness may

occur. Your heart rate will increase as a result of the effort exerted on the bike, although, your heart rate will be kept at or below moderate intensity (below 66% of your predicted heart rate reserve).

Possible risks to participating in exercise include experiencing some physical fatigue, sudden dizziness or nausea. If harm occurs, there is a phone in the lab we can use to dial 911 or campus security at 721-7599. The principle investigator is trained in CPR and First Aid and will provide service where appropriate. The PI will remain at the test at all times with the participant.

To minimize potential risks, this study requires that each participant who is a breast cancer survivor obtain medical clearance from their general practitioner to engage in two bouts of exercise. We will also screen all participants with a well-known reliable and valid screening tool used to assess a person's readiness to engage in a bout of exercise (PAR-Q). This tool tries to identify any contraindications or conditions that may be worsened with exercise. We will also be monitoring intensity throughout both exercise sessions with a heart rate monitor and by asking the participant to rate their perceived exertion level every two minutes. This will ensure participants stay within the specified intensity range during each exercise bout. Examples of moderate-intensity activities include fast walking, easy swimming, and folk dancing. In addition, the primary investigator is qualified as a Certified Fitness Consultant (CSEP), in CPR and Standard First Aid should an event occur. To minimize the emotional risk, we will warn participants of the potential psychological discomfort that may be experienced when answering some of the questions in the surveys. We will also remind participants that they may stop exercising or refuse to answer a question(s) at any time. In addition, we will ask participants how they are feeling before they leave the laboratory and ask them to please advise their physician if they experience any discomfort during the rest of the day. Confidentially will be ensured and kept.

Here are some answers to possible questions and concerns with regards to participating in this study potential participants may have:

What do I have to do to participate?
You will first need to fill out the required consent forms you received in your research package. One form requires a signature from your general physician if you are a breast cancer survivor. Then, you should call the primary researcher to book two testing times and receive directions to the University of Victoria, Behavioural Medicine Laboratory. At your first scheduled time, you should come to the laboratory with your completed forms dressed in comfortable clothing and ready to engage in a bout of physical activity. Participation in this study will involve answering several questionnaires regarding current psychological well-being and your confidence in cycling for different amounts of time. Participation will also involve cycling for 20 minutes at no more than moderate intensity. Of course, you may stop exercising at any time or refuse to answer any question.

In terms of protecting your anonymity and confidentiality, we do not ask you to put your name on the questionnaires that you will be filling out and you will be the only participant exercising in the lab during your scheduled time unless you request otherwise (it is possible to be tested at the same time as a friend or family member). The only place your name will appear is on the medical clearance form that will need to be signed by your physician. This form however, will not be kept together with the other data/questionnaires collected so there will be no way of associating your name with any specific data collected. The original questionnaires will be kept in a locked filing cabinet in the Behavioural Medicine Laboratory and will be shredded within five years time. Only the main investigator (myself) will have access to the data. Further, all data will be reported in aggregate so that no single case or name will be identified.

Will the exercise be stressful?
The exercise bout will cause your heart to beat faster than usual and may cause you to sweat. If you have not recently engaged in any physical activity, some muscle soreness may occur. The intensity will be kept at a moderate or lower level, equivalent to a moderate to fast walking pace. In addition, your perceived exertion level will be monitored every two minutes throughout the exercise bout via your verbal evaluation and a heart rate monitor. Again, you may stop exercising at any time during the test if you choose to do so.

Do I have to participate?
Of course not! Your participation in this study is completely voluntary. If you choose not to participate in this study, please disregard this research package. However, it is only through voluntary participation in research projects that we increase our knowledge about coping strategies for enduring the cancer experience. We hope that you can find the time to assist us. If you have any questions about the study, or about completing the forms, do not hesitate to call the number provided below. Parking and any fees required for obtaining physician approval will be reimbursed upon arrival at the Behavioural Medicine Laboratory. If you decide to withdraw from the study part way through, your data will be shredded and will not be used.

It is anticipated that the results of this study will be shared at scholarly conferences and in scientific journals.

In addition to being able to contact the primary investigator, **Rachel Blacklock at (250) 881-6169** or her supervisor, **Dr. Ryan Rhodes at (250) 721-8384**, you may verify the ethical approval of this study, or may raise any concerns you might have by contacting the Associate Vice President, Research at the University of Victoria (250) 472-4362.

Please give your consent with full knowledge of the nature and purpose of the procedures, the benefits that you may expect and the discomforts/risks that may be encountered. We appreciated your assistance. You may keep one copy of this form and the other is to be signed and given to the researcher upon your first testing session at the Behavioural Medicine Laboratory. Your signature below indicates that you have read and understand the information provided on the above conditions of participation and that you have had the opportunity to have your questions answered.

_____
Signature of Subject Agreeing to Participate
By signing this consent you certify you are at least 19 years of age

Please keep a copy of this form for your own records.

Appendix E

The Effects of Exercise Intensity and Self-Efficacy on Psychological Well-being with Cancer Survivors

MEDICAL CLEARANCE FORM

Dear Dr.,

You are receiving this form because your patient, _____ has elected to participate in a research study regarding exercise, psychological well-being and the cancer experience. This research is being conducted by Rachel Blacklock, a graduate student in the School of Physical Education at the University of Victoria, as a requirement for the degree of Master of Science in Behavioural Medicine. In order to take part in this investigation, all participants will be expected to engage in two separate bouts of physical activity. Participants will be asked to cycle on an ergometer for 20 minutes each session while heart rate and perceived exertion are monitored. Intensity of the exercise bouts will not exceed 66% of each individual's heart rate reserve. Participants in the cancer group must have completed treatment within the past 12 months.

You are welcome to contact Rachel Blacklock (881-6169; rachelb@uvic.ca) or the faculty supervisor Dr. Ryan Rhodes (721-8384, rhodes@uvic.ca) at any time with questions regarding this research. More information is provided on the Informed consent form given to your patient.

In your opinion, is _____ capable of participating in this research investigation (please check one)? YES _____ NO _____
Please indicate the length of time your approval is valid _____

Physician Signature _____

Physician's Name (please print):_____

Date: _____

Behavioural Medicine Laboratory UVic

Appendix F

PARTICIPANT PROFILE

Demographic Information:

1. Age: _____ 2. Gender: Male _____ Female _____

3. Height: _____ feet _____ inches 4. Weight: _____ pounds

5. Ethnicity / Race: (Please fill in) _____

6. What is the highest level of education that you completed? Mark only one.

- ○ 8th grade or less
- ○ Some high school
- ○ High school diploma
- ○ Vocational school / trades
- ○ Attended college or university
- ○ Diploma (from college or university)
- ○ Degree (Bachelors)
- ○ Professional or graduate degree

7. What is your current martial status? Mark only one.

- ○ Never married
- ○ Separated
- ○ Living with a partner
- ○ Divorced
- ○ Married
- ○ Widowed

8. In relation to your job please mark the one answer that fits you best.

- ○ Temporarily Unemployed
- ○ Student (ie: University)
- ○ Retired
- ○ Homemaker
- ○ Paid part-time employment
- ○ Paid full-time employment
- ○ Volunteer

9. What is your annual family income?

____$5,000 or less	____$5001 to $10,000	____$10,001 to $20,000
____$20,001 to $40,000	____$40,001 to $75,000	____More than $75,000

10. Where do you live (City/District)?

_____

Medical/Cancer History:

1.Type of Cancer: _____

2.a) Date of initial diagnosis: _____

b) Date of diagnosis of recurrence (if applicable):

_____

3. Stage of cancer at initial diagnosis (I-IV): _____

4. Cancer treatments received (please check all that apply and provide dates):

a) Surgery: _____ Date(s): _____

b) Lymph node removal: _____ Date(s): _____

c) Radiotherapy: _____ Date(s): _____

d) Chemotherapy: _____ Date(s): _____

e) Hormonal or immunotherapies: _____ Date(s): _____

5. Date of completion of all cancer treatments (not including hormonal therapies if currently prescribed). Date: _____

Leisure Time Activity Questionnaire:

1. a) Have you ever engaged in a regular aerobic exercise routine? Yes ____ No ____

b) If Yes, how long ago?

- ○ Currently engage in regular physical activity
- ○ Last Week
- ○ 1 Month
- ○ 6 Months
- ○ 12 Months
- ○ 24 Months
- ○ More than 24 Months?

2. Recall your average weekly exercise over the past 6 weeks. How many times, on average, did you do the following kinds of exercise over the past week?

When answering these questions please:

- □ only count exercise lasting longer than 15 minutes per bout.
- □ only count exercise that was done during free time (i.e., not occupation or housework).
- □ note that the main difference between the three categories is the intensity of the exercise.

□ please write the average frequency on the first line and the average duration on the second line.

	Times Per Week	Average Duration
a. STRENUOUS EXERCISE (HEART BEATS RAPIDLY, SWEATING)	_____	_____
(e.g., running, jogging, hockey, soccer, squash, cross country skiing, vigorous swimming, vigorous long distance bicycling, vigorous aerobic dance classes, heavy weight training)		
b. MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION)	_____	_____
(e.g., fast walking, baseball, tennis, easy bicycling, volleyball badminton, easy swimming, alpine skiing, popular and folk dancing)		
c. MILD EXERCISE (MINIMAL EFFORT, NO PERSPIRATION)	_____	_____
(e.g., easy walking, yoga, bowling)		

TAI Y-2

Read each statement and then circle the appropriate number under each statement to indicate how you feel **in general**. There are no right or wrong answers. Do not spend too much time on any one statement but give honest answers which seem to describe how you generally feel.

---

1. I feel pleasant

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

2. I feel nervous and restless

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

3. I feel satisfied with myself

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

4. I wish I could be as happy as others seem to be

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

5. I feel like a failure

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

6. I feel rested

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

7. I am "calm, cool, and collected"

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

8. I feel that difficulties are piling up so that I cannot overcome them

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

9. I worry too much over something that really doesn't matter

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

10. I am happy

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

11. I have disturbing thoughts

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

12. I lack self-confidence

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

13. I feel secure

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

14. I make decisions easily

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

15. I feel inadequate

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

16. I am content

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

17. Some unimportant thought runs through my mind and bothers me

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

18. I take disappointments so keenly that I can't put them out of my mind

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

19. I am a steady person

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

20. I get in a state of tension or turmoil as I think over my recent concerns and interests

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

Expectancy Values

Clearly circle the number that best describes your thoughts and feelings on expected health outcomes **due to engaging in physical activity**. Please be as honest as possible.

---

1) A major health benefit for me is to **stay in shape.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

2) A major health benefit for me is making **me feel better in general.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

3) A major health benefit for me is **good health**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

4) A major health benefit for me is **maintaining proper body weight.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

5) A major health benefit for me is **improving appearance.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

6) A major health benefit for me is **enhancing self-image and confidence.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

7) A major health benefit for me is the **positive psychological effect.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

8) A major health benefit for me is **stress reduction and relaxation.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

9) A major health benefit for me is **fun and enjoyment**.

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

10) A major health benefit for me is to **help cope with life's pressures.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

11) A major health benefit for me is to **weight loss.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

---

12) A major health benefit for me is **companionship.**

1	2	3	4	5
STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE

THANK YOU!!

Physical Activity Readiness
Questionnaire - PAR-Q
(revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

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

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

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

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

If you answered YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to <u>all</u> PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

→

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

<u>Informed Use of the PAR-Q</u>: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

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

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT _____ WITNESS _____
or GUARDIAN (for participants under the age of majority)

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

Supported by: Health Canada Santé Canada

continued on other side...

...continued from other side

PAR-Q & YOU

Physical Activity Readiness Questionnaire - PAR-Q (revised 2002)

CANADA'S Physical Activity Guide to Healthy Active Living

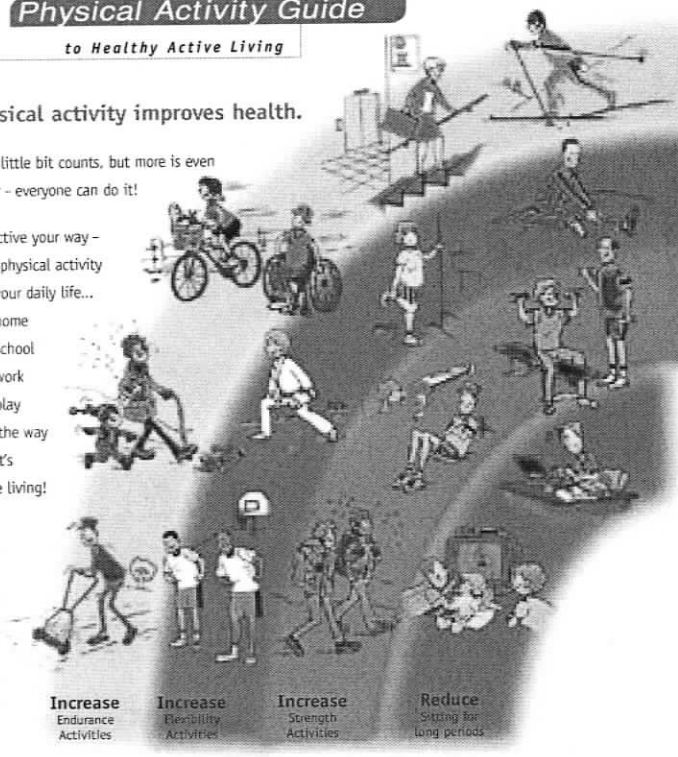
Physical activity improves health.

Every little bit counts, but more is even better - everyone can do it!

Get active your way - build physical activity into your daily life...

- at home
- at school
- at work
- at play
- on the way

...that's active living!



Choose a variety of activities from these three groups:

Endurance
4-7 days a week
Continuous activities for your heart, lungs and circulatory system.

Flexibility
4-7 days a week
Gentle reaching, bending and stretching activities to keep your muscles relaxed and joints mobile

Strength
2-4 days a week
Activities against resistance to strengthen muscles and bones and improve posture.

Starting slowly is very safe for most people. Not sure? Consult your health professional.

For a copy of the *Guide Handbook* and more information: **1-888-334-9769**, or **www.paguide.com**

Eating well is also important. Follow *Canada's Food Guide to Healthy Eating* to make wise food choices.

Get Active Your Way, Every Day – For Life!

Scientists say accumulate 60 minutes of physical activity every day to stay healthy or improve your health. As you progress to moderate activities you can cut down to 30 minutes, 4 days a week. Add-up your activities in periods of at least 10 minutes each. Start slowly... and build up.

Time needed depends on effort

Very Light Effort	Light Effort *60 minutes*	Moderate Effort *30-60 minutes*	Vigorous Effort *20-30 minutes*	Maximum Effort
• Strolling • Dusting	• Light walking • Volleyball • Easy gardening • Stretching	• Brisk walking • Biking • Raking leaves • Swimming • Dancing • Water aerobics	• Aerobics • Jogging • Hockey • Basketball • Fast swimming • Fast dancing	• Sprinting • Racing

Range needed to stay healthy

You Can Do It – Getting started is easier than you think

Physical activity doesn t have to be very hard. Build physical activities into your daily routine.

- Walk whenever you can – get off the bus early, use the stairs instead of the elevator.
- Reduce inactivity for long periods, like watching TV.
- Get up from the couch and stretch and bend for a few minutes every hour.
- Play actively with your kids.
- Choose to walk, wheel or cycle for short trips.
- Start with a 10 minute walk – gradually increase the time.
- Find out about walking and cycling paths nearby and use them.
- Observe a physical activity class to see if you want to try it.
- Try one class to start – you don t have to make a long-term commitment.
- Do the activities you are doing now, more often.

Benefits of regular activity:	Health risks of inactivity:
· better health · improved fitness · better posture and balance · better self-esteem · weight control · stronger muscles and bones · feeling more energetic · relaxation and reduced stress · continued independent living in later life	· premature death · heart disease · obesity · high blood pressure · adult-onset diabetes · osteoporosis · stroke · depression · colon cancer

Health Canada Santé Canada

Canadian Society for Exercise Physiology

Source: Canada's Physical Activity Guide to Healthy Active Living, Health Canada, 1998 http://www.hc-sc.gc.ca/hppb/paguide/pdf/guideEng.pdf

FITNESS AND HEALTH PROFESSIONALS MAY BE INTERESTED IN THE INFORMATION BELOW:

The following companion forms are available for doctors' use by contacting the Canadian Society for Exercise Physiology (address below):

The **Physical Activity Readiness Medical Examination (PARmed-X)** – to be used by doctors with people who answer YES to one or more questions on the PAR-Q.

The **Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for Pregnancy)** – to be used by doctors with pregnant patients who wish to become more active.

References:

Arraix, G.A., Wigle, D.T., Mao, Y. (1992). Risk Assessment of Physical Activity and Physical Fitness in the Canada Health Survey Follow-Up Study. **J. Clin. Epidemiol.** 45:4 419-428.

Mottola, M., Wolfe, L.A. (1994). Active Living and Pregnancy, In: A. Quinney, L. Gauvin, T. Wall (eds.), **Toward Active Living: Proceedings of the International Conference on Physical Activity, Fitness and Health**. Champaign, IL: Human Kinetics.

PAR-Q Validation Report, British Columbia Ministry of Health, 1978.

Thomas, S., Reading, J., Shephard, R.J. (1992). Revision of the Physical Activity Readiness Questionnaire (PAR-Q). **Can. J. Spt. Sci.** 17:4 338-345.

For more information, please contact the:

Canadian Society for Exercise Physiology
202-185 Somerset Street West
Ottawa, ON K2P 0J2
Tel. 1-877-651-3755 • FAX (613) 234-3565
Online: www.csep.ca

The original PAR-Q was developed by the British Columbia Ministry of Health. It has been revised by an Expert Advisory Committee of the Canadian Society for Exercise Physiology chaired by Dr. N. Gledhill (2002).

Disponible en français sous le titre «Questionnaire sur l'aptitude à l'activité physique - Q-AAP (revisé 2002)».

Supported by: Health Canada Santé Canada

Appendix H

SELF-EVALUATION QUESTIONNAIRE
SAI (Y1 Short Form)

Letter Assigned: _____ Date: _____

Age: _____ Sex: M ___ F ___

Read each statement and then circle the appropriate number under each statement to indicate how you feel **right now**, **at this moment**. There are no right or wrong answers. Do not spend too much time on any one statement but give honest answers which seem to describe your present feelings best.

---

1. I feel calm

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

2. I feel secure

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

3. I feel tense

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

4. I feel at ease

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

5. I feel anxious

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

---

6. I feel comfortable

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

7. I feel nervous

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

8. I am jittery

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

9. I am relaxed

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

10. I am over-excited or 'rattled'

1	2	3	4
NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO

Appendix I

SELF-EVALUATION
(copy to be given to the light-intensity group)

University of Victoria
Behavioural Medicine Laboratory

Letter Assigned: _____

Please answer the following questions as they pertain to the future. In other words, answer these questions as if you are **going to be** engaging in the specified duration of exercise. Keep in mind that there are no right or wrong answers.

On a scale from 0 – 100, rate your confidence in cycling on a stationary bike at light intensity (30-35% HRR) (0 = no confidence at all; 50 = moderately confident; 100 = completely confident), for the following specified durations:

10 Minutes.....	Rating _____
15 Minutes.....	Rating _____
20 Minutes.....	Rating _____
25 Minutes.....	Rating _____
30 Minutes.....	Rating _____
35 Minutes.....	Rating _____
40 Minutes.....	Rating _____
45 Minutes.....	Rating _____
50 Minutes.....	Rating _____
55 Minutes	Rating _____
60 Minutes	Rating _____

THANK YOU!!!

Appendix J

SELF-EVALUATION
(copy to be given to the moderate-intensity group)

University of Victoria
Behavioural Medicine Laboratory

Letter Assigned: _____

Please answer the following questions as they pertain to the future. In other words, answer these questions as if you are **going to be** engaging in the specified duration of exercise. Keep in mind that there are no right or wrong answers.

On a scale from 0 – 100, rate your confidence in cycling on a stationary bike at moderate intensity (60-65% HRR) (0 = no confidence at all; 50 = moderately confident; 100 = completely confident), for the following specified durations:

10 Minutes.....	Rating _____
15 Minutes.....	Rating _____
20 Minutes.....	Rating _____
25 Minutes.....	Rating _____
30 Minutes.....	Rating _____
35 Minutes.....	Rating _____
40 Minutes.....	Rating _____
45 Minutes.....	Rating _____
50 Minutes.....	Rating _____
55 Minutes	Rating _____
60 Minutes	Rating _____

THANK YOU!!!

Behavioural Medicine Laboratory UVic

Appendix K

Data Collection

Date: _____ Letter Assigned: _____ Time: _____

Assigned Intensity group (circle one): 30-35% or 60-65%

Age: _____

Resting Heart Rate: _____

Predicted Max HR (220 – age): _____

Heart Rate Reserve: _____
(HRMax - HRrest)

Lower Intensity target HR: _____
[(%intensity x HRR) + HRrest]

Higher Intensity target HR: _____
[(%intensity x HRR) + HRrest]

Completed:

- ○ Participant profile
- ○ Medical clearance
- ○ Informed consent
- ○ PAR-Q

Filled out:

- ○ SEQ form
- ○ SAI form
- ○ Warm-up 2 minutes 60 rpm
- ○ Intensity adjusted for target HRR

Borg Scale

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
very very light			very light		light		somewhat hard		hard		very hard		very very hard	

	Heart rate:	Borg Scale:
2 min	_____	_____
4 min	_____	_____
6 min	_____	_____
8 min	_____	_____
10 min	_____	_____
12 min	_____	_____
14 min	_____	_____
16 min	_____	_____
18 min	_____	_____
20min	_____	_____

- ○ SAI (2^{nd}) completed immediately
- ○ SEQ (2^{nd}) completed
- ○ SEQ (3^{rd}) completed
- ○ SAI completed (3^{rd})
- ○ Heart rate at 3^{rd} assessment _____bpm