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An Acute Exercise Session Increases Self-Efficacy in Sedentary Endometrial Cancer Survivors and Controls

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Abstract

Background—Self-efficacy can be affected by mastery experiences and somatic sensations. A novel exercise experience and associated sensations may impact self-efficacy and subsequent behaviors. We investigated the effect of a single exercise session on self-efficacy for sedentary endometrial cancer survivors compared with sedentary women of a similar age, but with no cancer history.

Methods—Twenty survivors and 19 controls completed an exercise session performed as a submaximal cycle ergometry test. Sensations and efficacy were measured before and after exercise. Repeated measures analysis of variance (ANOVA) was performed. Regression models were used to determine predictors of self-efficacy and subsequent exercise.

Results—Self-efficacy increased for both survivors and controls, but survivors had a higher rate of increase, and the change predicted subsequent exercise. The association between exercise-related somatic sensations and self-efficacy differed between the 2 groups.

Conclusions—A novel exercise experience had a larger effect on self-efficacy and subsequent exercise activity for endometrial cancer survivors than controls. Somatic sensations experienced during exercise may differ for survivors, which may be related to the experience of having cancer. Understanding factors affecting confidence in novel exercise experiences for populations with specific cancer histories is of the utmost importance in the adoption of exercise behaviors.

Keywords

special needs populations; exercise psychology; health behavior

Considerable evidence supports the positive association between exercise and health outcomes. Adopting and maintaining a physically active lifestyle is an important intervention for cancer survivors because it can improve their emotional well-being,¹ physical functioning and symptoms,² as well as reduce the risk of other chronic disease, such as cardiovascular disease,³ noninsulin dependent diabetes mellitus,⁴ osteoporosis,⁵ and reduce the risk of recurrence and second primary cancers.^{6,7} While these and other studies document the benefits of physical activity for both the general population and cancer survivors, the behavioral mechanisms that promote the initiation and maintenance of a physical activity lifestyle have received less attention.

Social Cognitive Theory (SCT) is a well-researched integrative theory of how people acquire skills and adopt behaviors.⁸ In SCT, a key determinant of behavior is *self-efficacy* or “confidence” in one's own capabilities⁸ to engage in a certain kind of behavior. Self-efficacy is very domain specific. The more efficacious people are in regards to physical activity, the more physically active they tend to become, and thus the greater the physical gains they can achieve.⁸ For previously sedentary individuals, perceptions of a novel exercise experience can lead to new cognitions about self-efficacy and thereby influence subsequent exercise behavior. One factor that can affect these self-efficacy cognitions is the person's awareness and subsequent interpretation of exercise-related somatic sensations. For physical activity, this can include the experience and interpretation of somatic sensations such as increased heart rate and respiration, muscle soreness, and fatigue. While these are common sensations in response to moderate or vigorous activity, individuals can attend to and interpret them differently. While some people may dwell on somatic states, others discount them. This effect may be heightened for those who have experienced a severe health event such as cancer, as they may interpret these somatic sensations as more threatening than those who have not experienced a health threat.⁹

Studies have shown that awareness and interpretation of somatic sensations affect self-efficacy. One study measured exercise self-efficacy before and after an exercise task on a cycle ergometer and measured global perceived exertion during the task. After controlling for preexercise self-efficacy, ratings of perceived exertion (RPE) were negatively associated with postexercise self-efficacy.¹⁰ Another study showed that self-efficacy was negatively correlated with RPE¹¹ at lower intensities. RPE is a global measure of somatic sensations reported as general perceived effort, not specific exercise-related sensations (eg, racing heart).

Individual differences in the effect of exercise-related somatic sensations on self-efficacy may exist for a number of reasons. The most obvious is that people with low levels of aerobic fitness may experience more sensations such as fatigue, shortness of breath, and muscle discomfort during activity. Although there is compelling evidence that exercising at the recommended levels will improve VO₂max, a measure of cardiorespiratory fitness, there is insufficient information on how cardio-respiratory fitness or other fitness parameters such as obesity or exercise history relate to somatic sensations and self-efficacy. While a few studies have shown weak associations between VO₂max and self-efficacy,^{10,12} the relationships among exercise histories, fitness, somatic sensations, and self-efficacy have not been systematically studied especially among cancer survivor populations. Understanding how these factors relate is of key importance in designing effective exercise interventions for cancer survivors.

The purpose of this pilot study was to investigate the effect of an acute exercise session, performed as a cardiorespiratory function assessment, on the exercise self-efficacy of previously sedentary endometrial cancer survivors and similarly-aged women with no history of cancer, and examine the effect of self-efficacy on subsequent exercise behavior.

We tested Bandura's Social Cognitive Theory⁸ model on the influence of fitness, somatic sensations on self-efficacy, and the relationship of self-efficacy to subsequent exercise (Figure 1). We further hypothesized that changes in self-efficacy from an acute exercise session would be associated with subsequent exercise behavior in the 2 groups studied.

Methods

Study Design

We present data from an initial pilot study for a parent study to investigate the determinants of exercise adherence for sedentary endometrial cancer survivors. The purpose of the pilot was to validate the assessment instruments and procedures for the larger study and to test for differences with a comparison group. Here, we present an analysis of data from the pilot participants and similarly matched women with no history of cancer on factors influencing exercise self-efficacy from a single exercise session (performed as a graded submaximal cycle ergometry exercise test), and predictors of subsequent exercise behavior in the following week.

Participants

The University of Texas M. D. Anderson Cancer Center Institutional Review Board reviewed and approved this study. Survivors had to be diagnosed with Stage I, II, or IIIa endometrial cancer within the past 5 years and be at least 6 months posttreatment. Controls had to have no history of cancer. Individuals from both study groups were excluded from the study if they engaged in activity that met or exceeded the current public health physical activity recommendations (ie, greater than 150 minutes of at least moderate intensity physical activity per week) and had done so for at least 6 months.^{13,14}

Survivors were recruited at the M. D. Anderson Gynecological Oncology Center and Gynecologic Oncology of Houston, a private gynecologic oncology clinic. Women returning to M. D. Anderson for follow-up care received a letter containing information about the study and a number to call if they were not interested in being contacted. For those interested, the recruitment coordinator met with the woman to obtain informed consent. At Gynecologic Oncology of Houston, the clinic's physician assistant identified women who met the inclusion criteria. The recruitment coordinator then met with the patient at the clinic to explain the study, screen for eligibility, and obtain informed consent.

Control group participants were recruited from Kelsey-Seybold Clinic, a multispecialty healthcare organization. A research assistant at the Kelsey Research Foundation identified eligible participants in the Kelsey-Seybold database and sent patients a form to return if they were interested in the study. The recruitment coordinator called the participants who returned forms to screen for eligibility. Eligible participants were sent a packet containing an explanation letter, 2 copies of the informed consent document, and a medical release form to be filled out by their physician to obtain medical clearance to participate in the exercise study.

Figure 2 shows the flow of the participants through the pilot study. A total of 92 survivors were identified as potentially eligible, 89 from the Gynecologic Oncology Clinic at M. D. Anderson and 3 from Gynecologic Oncology of Houston. Of those, 30 were unable to be contacted; 62 were contacted by our staff, 35 (56%) of whom were interested. Of the 35, 31 were eligible; the 4 ineligible women were too physically active. Twenty-six of the 31 provided informed consent. Before the initial assessment session, 3 dropped out, leaving 23 survivors who were scheduled for the initial orientation session. Of those 3, 1 participant dropped out before attending the baseline session; another participant was unreachable; and

1 participant was dropped from the study due to an arrhythmia. In sum, 20 survivors completed this pilot study.

The Kelsey Research Foundation mailed 1531 letters, and 91 returned a form indicating their agreement to have Kelsey-Seybold release their contact information to M. D. Anderson. Of these, we were able to contact 72 (79%), 52 of whom were eligible. Of the 52 eligible women, 32 completed and returned consent forms. A total of 27 obtained medical release from their physician. Three were excluded due to arrhythmias and 5 dropped out. In sum, 19 controls completed the study.

Procedures

All assessments were completed at M. D. Anderson Behavioral Research and Treatment Center. Participants' height, weight, resting ECG, resting blood pressure and resting heart rate were taken. Participants responded to computer-based questionnaires to assess exercise self-efficacy and somatic sensations, and interpretation of somatic sensations (postexercise). They then performed a graded submaximal cycle ergometry exercise test. Cycle ergometry was chosen over treadmill testing due to a lessened risk of participants falling, relative ease of recording blood pressure and monitoring of the ECG. Before the start of exercise, research staff explained the exercise test sequence to the participants, including how to use the Borg RPE scale.¹⁵ The Borg RPE scale allows the exerciser to rate how hard she is working, using a scale that ranges from 6 ("No exertion at all") to 20 ("Maximal exertion"). Throughout the test, the participant was asked to pedal at a cadence of approximately 60 rpm. Cadence was monitored on the metabolic cart system. The metabolic cart, (Parvo True One, Sandy, UT), was used to measure gas exchange analysis during the exercise test and was also used to control resistance on the cycle ergometer per the protocol detailed below.

Participants began by pedaling with no resistance for 60 seconds, followed by a warm-up stage of 120 seconds pedaling at 20 watts (W) resistance. During the exercise stage, wattage increased by 1 W every 6 seconds until the participant reached either 85% of age predicted maximum heart rate, a sustained respiratory exchange ratio greater than 1.0, or signaled that she wished to stop. Blood pressure and heart rate were recorded every 2 minutes. Borg RPE was also recorded every 2 minutes to coincide with blood pressure and heart rate recordings. During the exercise and recovery stages, participants were monitored for cardiac rhythm and rate with continuous 12-lead ECG. During the recovery stage, blood pressure, heart rate and perceived exertion were recorded every minute. Gas exchange analysis was done on breath-by-breath analysis. Real time data obtained included: breath-by-breath measurements of VO_2 (ml/kg/min), VO_2 (L), VCO_2 (L), VE (L), VE/VO_2 (L), VE/VCO_2 (L), PetO_2 (mm Hg), PetCO_2 (mm Hg), and respiratory exchange ratio (VCO_2/VO_2). Within 10 minutes of postexercise, participants again responded to computer-based questionnaires to assess exercise self-efficacy and somatic sensations, with the addition of interpretation of somatic sensations experienced during exercise.

After completing all assessments, participants were given an exercise program tailored to their health and their fitness level as indicated by the exercise test. Participants were asked to exercise at a light to moderate intensity (3–6 METS; ie, brisk walking at 2.0 to 3.5 mph). Participants were told to exercise at an intensity of approximately a level of 12 (between "fairly light" and "somewhat hard") on the BORG RPE scale and were reminded about the RPE levels experienced during the exercise test to gain a reference. Exercise prescriptions were based on ACSM guidelines for moderate and high risk participants.¹⁶ Participants were told that they could break down the total minutes of exercise recommended (30 minutes per session) into intermittent bouts of exercise if they had time demand issues and/or felt they could tolerate the intermittent sessions better at the recommended intensity. Intermittent

sessions of exercise to accumulate activity is consistent with public health recommendations for physical activity.¹⁴ All participants were also given diaries to record their exercise sessions for the following 7 days. They were given prepaid mailers and asked to return each diary on a daily basis.

Participants received compensation of a \$40 gift card for the laboratory assessment session and a \$5 gift card for each daily diary returned (up to total \$75 possible).

Measures

Exercise Self-Efficacy

Exercise self-efficacy was measured before and after exercise with a questionnaire previously used by McAuley^{17–20} which assesses that one can sustain exercise for an increasing number of weeks. The questionnaire also assesses participants' confidence in their ability to exercise for increasing duration. A typical question is: "How confident am I that I can walk briskly for 20 minutes without stopping" with a range of responses from 1 = "not at all confident," to 5 = "extremely confident." The range of the time frame for minutes of walking was from 2 minutes to 1 hour (2 minutes, 5 minutes, 10 minutes, 20 minutes, 30 minutes, 45 minutes, 1 hour). Responses to the individual items were averaged to obtain an overall score. Reliability estimates using Cronbach's alpha were 0.93.

Somatic Sensations

Somatic sensations were assessed using a subset of items that target exercise-related sensations from the Pennebaker Inventory of Limbic Languidness (PILL).²¹ Participants were asked to indicate how much they were currently experiencing exercise-related symptoms on a Likert scale ranging from 1 = "not at all," to 5 = "very much." Ten symptoms were measured: 1) racing heart, 2) tightness in chest, 3) leg cramps, 4) out of breath, 5) sweating, 6) upset stomach, 7) stiff or sore muscles, 8) dizziness, 9) stiff joints, and 10) abdominal pain. The participants were asked to report how much they were aware of these symptoms at the time they were responding to the questionnaire. Internal consistency reliability of the PILL ranges from 0.88 to 0.91, and 2-month test-retest reliability ranges from 0.79 to 0.83.²¹ For our study, internal consistency reliability estimates using Cronbach's alpha were 0.86 for preexercise somatic sensations and 0.92 for postexercise somatic sensations.

Interpretation of Somatic Sensations

Interpretation of somatic sensations was assessed using 4 semantic differential items postexercise. Participants responded to the following question: "The physical sensations I experienced during exercise were:" The 4 pairs of differential items were "frightening-comforting," "abnormal-normal," "discouraging-encouraging" and "unpleasant-pleasant." The items were presented on a scale from most negative (1) (eg, "frightening") to most positive (5) (eg, "comforting"). The scores for each of the 4 items were then summed to yield an interpretation score (the higher the cumulative score, the more positive the interpretation). Internal reliability estimate using Cronbach's alpha was 0.91. This measure was administered postexercise.

Fitness

Fitness was measured by estimating $\text{VO}_{2\text{max}}$ ($\text{mlO}_2/\text{kg}/\text{min}$), using gas exchange analyses from the metabolic cart during the submaximal cycle ergometer test. Thirty-second averages of heart rate and oxygen uptake were obtained from the metabolic cart. These values were inputted into a regression analysis regressing oxygen uptake on exercise heart rate during the exercise stage of the fitness test. The equation was used to estimate $\text{VO}_{2\text{max}}$ from maximum

age-predicted heart rate.¹⁶ To assess body composition, body mass index (BMI, kg/m²) was used. Height and weight were obtained at the baseline fitness assessment before beginning the cycle ergometer test. Though not a direct measure of fitness, we also included a measure of history of sports and exercise participation using the sports and exercise history section of the Lifetime Total Physical Activity Questionnaire.²² It has a demonstrated test-retest reliability (0.72–0.87) and takes approximately 20 minutes to complete. We calculated the results into average MET-hrs/week.

Minutes of Exercise

The women were given diaries to record their exercise sessions for 7 consecutive days following the laboratory assessment session. Participants were asked to record the days they were active, to specify the time they started and stopped their exercise session, and to record the intensity of exercise using the same RPE scale used during the exercise test.¹⁵ Copies of the RPE scale were included in the diaries for easy reference. Because participants were told they could perform their prescribed minutes of exercise in intermittent bouts rather than 1 continuous bout; we used total minutes of self-reported exercise as the dependent variable.

Because participants wore Actigraph GT1M accelerometer (Actigraph L.L.C., Fort Walton Beach, FL) during the 7-day period, we were able to determine whether self-reported ratings of intensity and duration matched accelerometry-based information.²³ We found that self-reported duration matched very closely to the accelerometer data. Duration of activity measured by the accelerometer agreed with survivors' self-reports 83.5% of the time and with controls' self-reports 86.1% of the time. Intensity was reported less accurately when compared with accelerometer data. Intensity of physical activity matched self-reported for 55 (60%) bouts in the survivor group and for 45 (57%) bouts in the control group. Of the 24 mismatched bouts inaccurately reported by the survivor group, intensity was over-reported in 10 bouts and under-reported in 14 bouts. Of the 23 mismatched bouts inaccurately reported by the control group, intensity was over-reported in 14 bouts under-reported in 9 bouts. There were no significant differences between survivors and controls (Chi-squared, $P > .05$).²³ Thus, we used duration of activity for our measure of subsequent exercise.

Treatment of Data

Data were analyzed using SPSS 17 (SPSS Inc., Chicago, IL). Descriptive statistics, (means, ranges, standard deviations), were computed for the scores of preexercise self-efficacy, postexercise self-efficacy, preexercise somatic sensations, postexercise somatic sensation, interpretation of sensations, minutes of self-reported exercise, and fitness variables. Independent sample *t*-tests were run to compare mean differences between the 2 groups. Changes in exercise self-efficacy pre to postexercise and differences in scores between survivors and controls were tested using a repeated measures analysis of variance (ANOVA). The between subject effects were defined as the subjects status as a survivor or as a comparison group "control." The within subjects effects were defined as preexercise and postexercise. The interaction term of the between and within subject effects was used to determine if there was a significant difference between survivors and controls in the change in pre- to postexercise. To test for predictors of post exercise self-efficacy, regression models were run separately for survivors and controls. Similarly, to test for predictors of the minutes of exercise, separate regression models were also run.

Because of the small sample size, a model building approach was used to test for predictors of postexercise self efficacy while controlling for preexercise self-efficacy. This was done separately for survivors and controls. The first variables added to the model were preexercise somatic sensations and postexercise somatic sensations. The other variables from our model were then added 1 at time (lifetime of physical activity, VO₂max, BMI,

interpretation of somatic sensations) to test for significant predictors of postexercise self-efficacy.

Similarly, a model building approach was used to test for predictors of subsequent minutes of exercise. Potential predictor variables added 1 at a time to the model included change in self-efficacy pre- to postexercise, preexercise somatic sensation, postexercise somatic sensations, lifetime of physical activity, VO₂max, BMI and interpretation of somatic sensations.

Results

Twenty endometrial survivors and 19 control participants (Table 1) completed the study. Survivors and control participants were similar in age and physiological variables. The survivors' mean predicted cardiorespiratory capacity (VO₂max) of 18.8 ml O₂/kg/min is below the 10th percentile (VO₂max = 21.9) for women aged 50 to 60 years of age as published by ACSM.¹⁶ The control group's mean estimated capacity of 21.2 ml O₂/kg/min was slightly higher, but still below the 10th percentile and was not significantly different than the survivors ($P = .10$). Survivor and control participants were also of similar body mass index (30.9 kg/m², 29.5 kg/m², respectively, $P = 0.56$). Our pilot sample of endometrial survivors were similar in age, activity status and BMI to other endometrial populations in exercise studies.^{24,25}

There were no significant differences for self-efficacy, somatic sensations, and interpretation of somatic sensations between the 2 groups (Table 2). However, survivors had slightly lower mean levels of preexercise self-efficacy (mean = 2.86; SD = 0.96) when compared with the control group (mean = 3.10; SD = 1.00; $P = .12$).

Changes in Self-Efficacy

We next focused on change in self-efficacy from preexercise to postexercise (Table 3). Between subject effects indicate that there was no significant main effect for the difference in self-efficacy between survivors and controls ($P = .843$). The difference between cases and controls in the prepost self-efficacy change, denoted by the interaction of time and the survivor/control categorical variable, approached significance at $P = .117$. For the survivors, the exercise session was associated with a significant increase in self-efficacy (mean change = 0.46, SD = 0.61, $P < .001$). In the control group self-efficacy increased minimally (mean change = 0.12, SD = 0.72, $P = .48$). Figure 3 illustrates the difference between the survivors and controls in pre to postexercise change in self-efficacy.

Predictors of Post-Exercise Self-Efficacy

Among survivors, preexercise somatic sensations ($\beta = 0.58$, $P = .001$) and postexercise somatic sensations ($\beta = -0.32$, $P = .026$) were significantly associated with postexercise self-efficacy (Tables 4 and 5). For controls higher somatic sensations postexercise were significantly associated with lower postexercise self-efficacy ($\beta = -0.36$, $P = .008$); also, VO₂max was significantly associated with postexercise self-efficacy, ($\beta = 0.33$, $P = .01$). These results suggest a difference in predictors of postexercise self-efficacy between survivors and controls.

Predictors of Subsequent Week's Activity

Regression models, one for survivors and one for controls, were reviewed to determine predictors of duration of minutes of exercise activity for the following week. The only variable that was a significant predictor in either model was the difference in self-efficacy (postexercise self-efficacy minus preexercise self-efficacy) for survivors ($\beta = 0.54$, $P = .02$),

($R^2 = .25$, $F = 7.31$, $P = .015$) indicating that survivors with higher postexercise self-efficacy scores completed more minutes of exercise activity in the following week. All other variables (BMI, preexercise somatic sensations, postexercise somatic sensations, lifetime physical activity and $VO_2\text{max}$) were not significant predictors. There were no significant predictors for controls.

Discussion

We tested a component of Social Cognitive Theory predictors of exercise behavior, (Figure 1), investigating the effects of a single exercise session (performed as a sub-maximal cycle ergometry task) on exercise self-efficacy for 20 endometrial cancer survivors and 19 matched controls. Self-efficacy has been found to predict exercise adherence in longitudinal studies and mediate the effects of interventions to increase physical activity.^{17–19} Our results would add support to these findings. In support of the theory participants in both group of our pilot study increased self-efficacy preexercise to postexercise. Consistent with SCT,⁸ the mastery experience of completing the test may have contributed to this increased efficacy. Also in support of the model, postexercise somatic sensations were negatively associated with postexercise self-efficacy for both groups.

However, the experience of having cancer may vary these effects when compared with similar women with no history of cancer. Cancer survivors experienced a significant increase in self-efficacy from before to after the exercise test, and those with a greater change in self-efficacy performed more activity the following week. Interestingly, these associations did not hold true for the control group. Another difference between the 2 groups was that control participants who had higher estimated cardiorespiratory capacity ($VO_2\text{max}$) reported higher self-efficacy scores, but this association was not significant for the survivor group. The fact that $VO_2\text{max}$ was significant for controls and not survivors indicates some potentially important differences between those who have had cancer and those who have not with regard to exercise behavior. Our model predicts a relationship between VO_2 and self-efficacy, but perhaps for cancer survivors, something about the cancer experience causes a disconnect in that relationship. For example, cancer survivors may have cancer-related symptoms/side effects or be more uncertain about their readiness to exercise, and these factors could relate more to self-efficacy. The experiences of cancer often bring with it lingering symptoms of fatigue and decreases in physical functioning, which often translate into lower levels of physical activity.²⁶ However, it may also be the case that cancer survivors appraise their physical endurance as lower than it actually is. They may think they are doing worse than they actually are given the lingering physical symptoms. Our data suggest similar level of endurance, as measured by $VO_2\text{max}$, in this group of survivors and controls. Further study is needed to examine potential differences in appraisal of endurance and/or physical ability.

However, the fact that cancer survivors experienced a significant increase in self-efficacy during the exercise session, whereas controls did not further supports this hypothesis. Both cancer survivors and controls experienced increases in self-efficacy, however, the rate of increase was greater for survivors and this relationship approached statistical significance at $P = .117$. Being able to complete the exercise test may have been more of a “surprise” to the survivors who questioned their ability to do so. Consistent with SCT,⁸ the mastery experience of completing the test may have contributed to the survivors’ increased efficacy for the survivor group. Completion of the novel exercise test may have had a more pronounced effect on their self-efficacy because their perceptions about their ability to exercise may have been disrupted by the cancer diagnosis, thus making the exercise task more salient to their self-efficacy expectations.

This is also suggested by survivors' higher level of somatic sensations before exercise, (mean = 2.65 versus mean = 1.45), indicating perhaps poorer overall health or greater after-effects of body vigilance from treatment. Research by Benyamini and colleagues⁹ is suggestive of such an effect. They found that among elderly people with osteoarthritis, those with a history of cancer were more likely to monitor for cancer symptoms than those not affected by cancer. Perhaps the experience of having cancer greatly impacts somatic vigilance and confidence regarding physically demanding activities. Controls, on the other hand, because they have not experienced such a major health crisis, may have more stable efficacy expectations that were less subject to change by a single exercise session. Somatic sensations among the control group increased by an average of 1.53, while the survivor group increased by an average decrease of 0.15, which suggests a potential survivorship effect. While survivors may have received reassurance from the exercise experience because they experienced minimal somatic sensations as the result of exercise, controls may have found the exercise test more physically challenging than they expected, accounting for less positive change in self-efficacy from pre to postexercise. (It is important to note that both populations were previously sedentary; ie, they did not meet current physical activity recommendations.)

Limitations

Our results need to be interpreted in the light of several limitations. First, these were small samples that limited our ability to test differences between groups. Second, this was a short-term study, with change in self-efficacy and somatic sensations calculated from just 1 15-minute exercise session. Third, we used self-report in daily diaries to capture minutes of exercise performed in the subsequent week. Although we found a high agreement between self-report and accelerometer data, there is the limitation of biased self-report. Moreover, the exercise session was a highly structured laboratory experience with gas analysis equipment (complete with mouthpiece and nose clip), ECG with leads placed on chest, automated blood pressure cuff and a prescribed protocol of a graded submaximal cycle ergometry test with the testing staff provided verbal support and encouragement. The results of the exercise session on self-efficacy may very well have been different if the exercise experience occurred in a more naturalistic environment. Other unaccounted for variables could be affecting these relationships as well. In a study of college students performing acute exercise tasks, Bryan and colleagues found that ratings of perceived exertion were related to change in positive mood and positive mood was correlated with intention to exercise.²⁷ Future research could test a more comprehensive model that also incorporates state variables such as mood during exercise as well.

Implications

As early diagnosis and treatment of cancer continue to improve, more survivors will live longer and potentially face late effects of treatment and health problems that are exacerbated by the cancer experience. Sedentary life style can contribute to these problems.^{24,25} However, adopting and maintaining a physically active lifestyle can improve quality of life and long-term health for cancer survivors as they live throughout the cancer experience.^{1,7,28-31} Research such as this can inform the development of interventions to increase exercise in cancer survivors. This study's findings suggest that a single, supervised exercise session, including encouragement and reinforcement, increased survivors' self-efficacy and that increases in self-efficacy were associated with subsequent short-term adoption of exercise for a sample of endometrial cancer survivors. This exercise session likely constituted a key 'mastery experience,' providing new information to the survivors about the capability to exercise, thus leading to the increases in self-efficacy. While preliminary, our findings may suggest that exercise interventions for cancer survivors target mastery experiences early in the intervention. Early mastery experiences could potentially "boost"

self-efficacy at the intervention onset, which could hopefully result in less drop-out and greater long-term adherence.

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Figure 1.
Exercise self-efficacy model.

Figure 2.
Participant flow.

Figure 3.
Interaction of self-efficacy pre- and postexercise by survivor/control.

Table 1

Participant Baseline Characteristics

Variable	Survivor (n = 20)	Control (n = 19)	P
Age	58.5 ± 8.1	58.5 ± 9.0	0.92
Ethnicity			
Hispanic	2	4	
Non-Hispanic	18	15	
Race			
White	16	10	
African-American	2	5	
Asian	1	0	
American Indian	1	3	
Pacific Islander	0	1	
Education (4-year college degree)	70%	32%	
Survivor's disease variables		N/A	
Stage I	14	N/A	
Stage II	4	N/A	
Stage III	1	N/A	
Stage info missing	1	N/A	
Mean months since diagnosis	23.5 ± 14.3	N/A	
Cardiorespiratory VO ₂ max (mlO ₂ /kg/min)	18.8 ± 4.6	21.2 ± 4.1	0.10
Body mass index (kg/m ²)	30.9 ± 7.8	29.5 ± 6.6	0.56

Table 2

Descriptive Statistics (Self-Efficacy, Somatic Sensations, Interpretation of Sensations, Minutes of Exercise) and Differences Between Groups

Variable (potential range)	Survivor (Mean $\pm$ SD) (n = 20)	Control (Mean $\pm$ SD) (n = 19)	Difference (P)
Preexercise self-efficacy (1–5)	2.86 $\pm$ 0.96	3.10 $\pm$ 1.00	.117
Postexercise self-efficacy (1–5)	3.33 $\pm$ 0.96	3.22 $\pm$ 1.14	.745
Change in self-efficacy (1–5)	0.46 $\pm$ 0.61	0.12 $\pm$ 0.72	.117
Preexercise somatic sensations (1–5)	2.65 $\pm$ 4.22	1.47 $\pm$ 2.14	.284
Postexercise somatic sensations (1–5)	2.50 $\pm$ 3.90	3.00 $\pm$ 3.12	.662
Interpretation of sensations (5–20)	15.2 $\pm$ 3.16	16.1 $\pm$ 3.44	.404
Minutes of exercise	143.3 $\pm$ 86.8	166.4 $\pm$ 137.1	.731

Table 3

Pre- and Postexercise Self-Efficacy for Survivors and Controls

		Unadjusted mean ^a	SD
Survivor	Preexercise self-efficacy	2.86	0.96
	Postexercise self-efficacy	3.33	0.96
Control	Preexercise self-efficacy	3.10	1.00
	Postexercise self-efficacy	3.22	1.14

^aBetween groups: $F = 0.040$, $P = .843$; change in pre- to postexercise: $F = 7.450$, $P = .010$; interaction: $F = 2.580$, $P = .117$; degrees of freedom: (1, 37).

Table 4

Linear Regression Models Predictors of Postexercise Self-Efficacy: Survivors

	β	t	P
Preexercise self-efficacy	0.92**	8.55	0.000
Preexercise somatic sensations	0.58**	4.32	0.001
Postexercise somatic sensations	-0.32*	-2.44	0.026
Model *** $F = 26.23$, $P = .000$, adjusted $R^2 = .80$			

Note. Significant:*
 $P < .05$ **
 $P < .01$ ***
 $P < .001$.

Table 5

Linear Regression Models Predictors of Postexercise Self-Efficacy: Controls

	β	t	P
Preexercise self-efficacy	0.60**	5.32	0.000
Postexercise somatic sensations	-0.36**	-3.11	0.008
Estimated VO ₂ max	0.33*	3.00	0.010
Model *** $F = 21.70$, $P = .000$, adjusted $R^2 = .82$			

Note. Significant:*
 $P < .05$ **
 $P < .01$ ***
 $P < .001$.