

Social Cognitive Theory and Physical Activity During Breast Cancer Treatment

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Purpose/Objectives: To measure the association between physical activity and social cognitive theory constructs during breast cancer treatment.

Design: Cross-sectional survey.

Setting: Midwestern, academic oncology clinic.

Sample: 21 primarily Caucasian (90%) female patients with breast cancer undergoing treatment. 76% were ≥ 50 years old; 76% had stage I or II disease. 17 completed the study.

Methods: Survey (structured interview or self-administration), chart audit, pedometer, and seven-day physical activity recall.

Main Research Variables: Steps per day, energy expenditure, self-efficacy, barriers, partners and role models, prior physical activity counseling, physical activity knowledge, pretreatment physical activity, outcome expectations and values, goals, reinforcement management, and emotional well-being.

Findings: A higher average of steps per day was significantly associated with having an exercise role model and higher annual income. A higher daily energy expenditure (kilocalories per kilogram body weight per day) was significantly associated with higher barrier self-efficacy, higher task self-efficacy, having an exercise partner, having an exercise role model, higher physical activity enjoyment, and lower negative value score.

Conclusions: Social cognitive theory may provide a useful framework for understanding physical activity among patients with breast cancer during treatment, but correlation strength varies with physical activity measurement type.

Implications for Nursing: Social cognitive theory and physical activity during breast cancer treatment warrant additional study with larger sample sizes and multivariate analyses. Interventions to increase physical activity among patients with breast cancer may use social cognitive theory and assess theory constructs as potential mediators or moderators in intervention evaluation.

Key Points . . .

- Barrier and task self-efficacy are important social cognitive theory constructs to consider for understanding physical activity behavior or designing physical activity interventions for patients with breast cancer during treatment.
- Careful selection of physical activity assessment is needed because the specific methodology may influence observed associations between social cognitive theory constructs and physical activity behavior.
- Future research evaluating physical activity and social cognitive theory in patients with breast cancer should enroll a sufficient number of participants to allow multivariate analysis evaluating all constructs simultaneously to determine the most important constructs.
- Physical activity interventions for patients with breast cancer should address barrier and task self-efficacy, physical activity enjoyment, exercise partners, exercise role models, perceived exercise barriers, and pretreatment physical activity behavior.

patients with cancer during treatment (Dishman, 1994; Glanz, Lewis, & Rimer, 1997). Because physical activity correlates and mechanisms differ for different groups of patients with cancer, depending on cancer type, focusing specifically on patients with breast cancer is important (Blanchard, Courneya, Rodgers, & Murnaghan, 2002; Courneya, Blanchard, & Laing,

Exercise has a beneficial impact on psychological and physiologic factors among patients with breast cancer (Courneya, Mackey, & Fairey, 2003). Randomized, controlled trials have suggested that exercise can improve quality of life, fatigue, body composition, flexibility, aerobic fitness, and cancer-related immune system components (Burnham & Wilcox, 2002; Courneya, Friedenreich, et al., 2003; Courneya, Mackey, et al., 2003; Courneya, Mackey, & Fairey; Fairey, Courneya, Field, & Mackey, 2002; Irwin & Ainsworth, 2004; Mock et al., 1997, 2001).

In an effort to bring what is known about the benefits of exercise to a larger number of patients with breast cancer, exercise-promotion programs must be designed. Such programs should be grounded in proven behavior theory and reflect the unique physical activity correlates and barriers experienced by

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2001; Courneya & Friedenreich, 1999). Furthermore, physical activity and its correlates vary based on time since diagnosis (Demark-Wahnefried et al., 2001; Pinto, Eakin, & Maruyama, 2000; Pinto, Trunzo, Reiss, & Shiu, 2002), supporting the importance of studying physical activity behavior and correlates during and after adjuvant therapy.

Social cognitive theory is based on a dynamic and reciprocal model of interactions among behavior, personal factors, and environmental influences, and self-efficacy is considered the key construct in the theory (Bandura, 1986). Self-efficacy concerns a person's confidence in his or her ability to perform a certain behavior; the primary sources of efficacy information include performance experience, verbal persuasion, vicarious experience, and physiologic and affective states (Bandura). Application of this theory is useful in understanding and enhancing physical activity behavior (Glanz et al., 1997).

Prior studies evaluating physical activity correlates among patients with breast cancer have focused on survivors months to years after completion of therapy. Of the studies, the only social cognitive theory construct evaluated has been barrier self-efficacy (i.e., confidence in ability to overcome barriers to behavior performance) (Pinto, Maruyama, et al., 2002). Other aspects of social cognitive theory have not been assessed. Only two studies have evaluated physical activity in patients during treatment, but neither applied social cognitive theory (Courneya & Friedenreich, 1999; Rhodes, Courneya, & Bobick, 2001). Both studies were limited by a retrospective design, creating the possibility for recall bias and measurement error, and a lack of an objective measure of physical activity. Studies are needed at the time of treatment evaluating other physical activity correlates such as social cognitive theory constructs.

Therefore, the current study aimed to measure, among patients with breast cancer receiving adjuvant therapy, the associations among physical activity and the following potential correlates in the framework of social cognitive theory: self-efficacy, barriers, partners and role models, prior physical activity counseling, physical activity knowledge, pretreatment physical activity, outcome expectations and values, goals, reinforcement management, and emotional well-being.

Literature Review

Social Cognitive Theory and Physical Activity

Social cognitive theory considers the key construct of self-efficacy (i.e., a person's confidence in his or her ability to perform a certain behavior). If an individual feels more confident that he or she can successfully engage in a certain behavior (e.g., overcome barriers), he or she is more likely to engage in that activity, and interventions that improve self-efficacy will increase behavior compliance. Social cognitive theory is well recognized as a useful framework for the design of physical activity interventions (Glanz et al., 1997; McAuley, 1992) but has not been studied adequately among breast cancer survivors. Although the theory of planned behavior has been studied in breast cancer survivors (Courneya & Friedenreich, 1999), a direct comparison of the two theories among 328 adults followed for seven weeks demonstrated that social cognitive theory accounted for greater variance in physical activity behavior, suggesting potentially greater usefulness of this theory (Dzewaltowski, 1989).

In addition to self-efficacy, behavior also is influenced by outcome expectations (Bandura, 1986; Keller, Fleury, Gregor-Holt, & Thompson, 1999). Outcome expectations are defined as the expected results that will occur with performance of a behavior (Bandura). Outcome expectations have been found to be significantly associated with physical activity although not as consistently as self-efficacy (Keller et al.). Importantly, interventions to increase physical activity that have focused on outcome expectations and self-efficacy have demonstrated effectiveness in increasing physical activity participation (Keller et al.). Keller et al. stated that despite the association between outcome expectations and physical activity, most studies fail to measure the construct when evaluating social cognitive theory.

Outcome-expectancy theories (i.e., expectancy-valence theories) further consider the impact of the value (i.e., importance) of an expected outcome on an individual's behavior (Bandura, 1986). Specifically, the approach theorizes that behavior is a multiplicative function of an expected outcome (i.e., outcome expectation) and the value of that outcome (Bandura). Furthermore, the value of expected outcomes often is not included in studies evaluating outcome expectations and deserves additional study. When studied, the outcome-expectancy value (i.e., multiplicative function of the outcome expectations and related importance and value) has been positively influenced by physical activity interventions (Hallam & Petosa, 1998) and significantly correlated with physical activity participation (Steinhardt & Dishman, 1989).

Other important social cognitive theory constructs applied to behavior-change programs include environment (e.g., physical, social, situational), behavioral capability (e.g., knowledge, skill), self-control (e.g., goal-directed behavior), observational learning (e.g., role models), reinforcements (e.g., use of incentives), and emotional coping responses (e.g., stress management) (Glanz et al., 1997). As sources of efficacy and outcome information, the influence of these additional constructs on physical activity behavior are mediated by self-efficacy and outcome expectations and values (Bandura, 1986) (see Figure 1). Prospective studies evaluating social cognitive theory in a multilevel theoretical framework have demonstrated the importance of behavioral, affective,

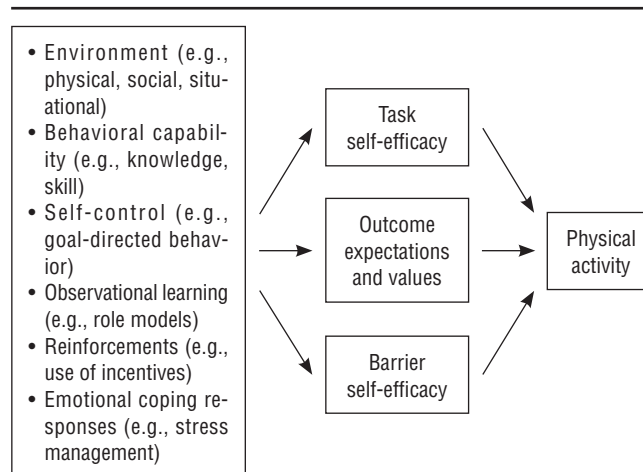


Figure 1. Social Cognitive Theory and Physical Activity Behavior

and social influences on self-efficacy for exercise adherence and the need for further research (McAuley, 1992; McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003).

Application of Social Cognitive Theory to Patients With Cancer

Although only one study has evaluated social cognitive theory (i.e., barrier self-efficacy) and physical activity in cancer survivors (Pinto, Maruyama, et al., 2002), social cognitive theory has demonstrated usefulness in understanding other health-related behaviors in patients with cancer (Haas, 2000). The applications have focused primarily on compliance with cancer-prevention programs (e.g., breast self-examination), smoking cessation, and adjustment to cancer diagnosis (e.g., self-care, self-efficacy) (Lev, 1997). Similar usefulness for physical activity behavior is expected, but additional research is needed to assess the relationship between physical activity and social cognitive theory constructs such as self-efficacy (Haas).

Application of Social Cognitive Theory to Health Education

Applying behavior theory to practical interventions is a necessary challenge for research scientists and health educators and practitioners. Leading experts in the field of health education have outlined recommendations for “operationalizing” social cognitive theory constructs for the purpose of designing behavior-change interventions (Glanz et al., 1997). The current study used the pragmatic definitions of social cognitive theory constructs to enhance the practical usefulness of the results. The researchers chose to measure barrier self-efficacy (i.e., confidence in ability to overcome barriers to behavior performance) and task self-efficacy (i.e., confidence in ability to perform the constituent components of the task). Although Glanz et al. used the term “expectancy” to describe the importance of an expected outcome, the researchers in the current study chose to use the term “value” to avoid confusion that may occur as a result of the interchangeable use of the terms “expectation” and “expectancy” found in the literature (Williams, Anderson, & Winett, 2005).

Methods

This cross-sectional study was carried out in the School of Medicine Breast Center and Oncology Clinics at Southern Illinois University. Approval for the study was obtained through the local human assurance committee, and informed consent was obtained from all participants by the research staff before initiation of any study measurements.

Sample Criteria, Selection, and Recruitment

Participants were female patients with breast cancer and met the following inclusion criteria: 18 years of age or older, English speaking, cognitively capable of answering questions accurately and following directions for use of a pedometer, currently undergoing adjuvant therapy (i.e., chemotherapy, radiation therapy, or hormonal therapy), and at least six weeks after surgery for breast cancer. Exclusion criteria included patients with carcinoma in situ only or with metastatic disease at time of enrollment.

Because of time constraints, the research staff could not attend consecutive oncology clinics, so a convenience sampling technique was used. During each (randomly selected)

clinic attended by the research staff, the staff completed a brief review of medical records for eligibility of all patients attending the clinic that day. The research staff then provided a brief description of the study and invitations to participate to potentially eligible patients.

Instruments

Physical activity: Physical activity was measured subjectively by the seven-day physical activity recall (Sallis et al., 1985). The measurement was chosen because of its proven reliability and validity in multiple studies (Montoye, Kemper, Saris, & Washburn, 1996). Daily energy expenditure was calculated from the seven-day physical activity recall according to protocol and expressed as kilocalories per kilogram body weight per day (kcal/kg per day) (Sallis et al.).

Physical activity was measured objectively by the Yamax SW-701 Digi-Walker pedometer (Yamax, Tokyo, Japan) (i.e., step counter) for seven days. The pedometer was chosen as the objective measure of physical activity because it is recognized as an inexpensive, user-friendly, and practical measure for surveillance, program evaluation, and intervention purposes (Tudor-Locke & Myers, 2001; Tudor-Locke, Myers, & Rodger, 2001). Moreover, walking is the most common form of physical activity in cancer survivors, with more than 80% preferring it as their primary mode of exercise (Jones & Courneya, 2002). This particular brand of pedometer was used because it has performed consistently well under controlled (Bassett et al., 1996; Crouter, Schneider, Karabulut, & Bassett, 2003; Le Masurier, Lee, & Tudor-Locke, 2004; Schneider, Crouter, Lukajic, & Bassett, 2003) and free-living conditions (Le Masurier et al.; Schneider, Crouter, & Bassett, 2004), and it is considered the criterion pedometer in physical activity assessment (Schneider et al., 2004). A mean daily step count was calculated from the average number of steps recorded by the pedometer for each 24-hour period.

Survey: The survey assessed demographic variables and social cognitive theory constructs. Survey items were derived from multiple sources, and survey completeness was assessed by three focus groups of patients with breast cancer (Rogers et al., 2004). The demographic variables included age, ethnicity, years of education, employment status, and average annual household income. Age was categorized for descriptive purposes but was analyzed as a continuous variable. The remaining survey variables were chosen based on consistency with social cognitive theory constructs (Glanz et al., 1997).

Two aspects of self-efficacy were assessed. Barrier self-efficacy was measured using a five-item scale previously tested for reliability and validity (i.e., two-week test-retest reliability of 0.90; scale significantly differentiated individuals at different physical activity levels) (Marcus, Selby, Niaura, & Rossi, 1992). Barrier self-efficacy is an individual's confidence in his or her ability to overcome barriers (e.g., “How confident are you that you can exercise when you are tired?”). Task self-efficacy was measured using a four-item scale developed for patients with chronic disease (i.e., coefficient alpha of 0.86 [Rogers, Humphries, Davis, & Gutin, 1998]). Task self-efficacy is an individual's confidence in his or her ability to perform the constituent components of a task (e.g., “Rate your confidence in your ability to walk 20 minutes without stopping.”). Confidence (i.e., self-efficacy) for both scales was rated on a Likert scale from 1–5 (0 = not at all confident to 5 = extremely confident). The mean score for each self-efficacy scale was used for analysis.

Environment was assessed in three ways. The perceived barriers scale used in the survey created, tested, and utilized in the Physical Activity for Risk Reduction (PARR) study (Lewis et al., 1993) was expanded to include additional barriers suggested by three focus groups with patients with breast cancer (Rogers et al., 2004). Participants were asked to rate on a 5-point Likert scale (1 = never to 5 = very often) how often 30 different barriers interfered with exercise. The items were summed for a perceived barriers score. Coefficient alpha for the barriers score in the study sample was 0.89. Exercise partner was measured by a single question from a prior study (Rogers et al., 2005) asking whether the participant exercised regularly with an exercise partner (four possible responses: most of the time, some of the time, occasionally, never or rarely). Responses were dichotomized for analysis as having an exercise partner or not. Physical activity counseling was measured using a yes-or-no question developed specifically for the study by the focus groups (Rogers et al., 2004) asking if the participant ever had been provided with recommendations concerning breast cancer treatment and physical activity by a physician or nurse.

Behavioral capability was measured in two ways. Knowledge of physical activity recommendations was measured using a yes-or-no question developed specifically for the study asking whether a woman undergoing breast cancer treatment should participate in exercise. Pretreatment physical activity stage of change (i.e., readiness for physical activity behavior change) was measured with questions previously tested for validity and reliability (i.e., Kappa index over a two-week period of 0.78; significant associations with other measures of physical activity) (Marcus, Selby, et al., 1992). Participants were asked to recall their stage of change prior to their diagnosis of breast cancer. Recall of pretreatment stage of change has been used successfully in a previous study of patients with breast cancer (Rhodes et al., 2001). The stage of change questions were classified into the five stages (precontemplation, contemplation, preparation, action, and maintenance) (Marcus, Selby, et al.).

Physical activity expectations and the importance of these expectations (i.e., values) were measured in several ways. Physical activity enjoyment was measured with a single item (5-point Likert scale) asking the participant to rate her enjoyment in engaging in regular exercise. A similar single-item approach has been used successfully in a prior study (Courneya & Friedenreich, 1999). Physical activity fear was measured with a single item (5-point Likert scale) asking the participant to rate her fear of exercise. The item was developed specifically for the study. The physical activity expectations and values scale used in the survey created, tested, and utilized in the PARR study (Lewis et al., 1993) was expanded to include additional expectations and values suggested by the focus groups (Rogers et al., 2004). For expectations, participants were asked to rate their agreement on a 5-point Likert scale with the statement that exercise would provide 16 specific benefits or risks (e.g., feel less depressed, increased joint pain). For the values (i.e., importance), participants were asked to rate on a 3-point Likert scale for each of the 16 different expectations the importance of achieving the specific benefit or avoiding the risk. Responses for the expected benefits were summed for a positive expectation score, and responses for the importance of the expected benefits were summed for a positive value score. A positive outcome-expectancy value was calculated by summing the multiplicative function for each expectation and

its corresponding value (i.e., $\Sigma OE \times E$). This methodology of creating a multiplicative function was chosen because of its consistency with expectancy value theory considered in the social cognitive theory framework (Bandura, 1986). A similar process was used to calculate the negative expectations score, negative value score, and negative outcome-expectancy value. All benefits and risks (i.e., positive and negative outcome expectations and values) were combined for the total expectation score, total value score, and total outcome-expectancy value. Negative outcome expectations were reversed for the calculation of the combined total scores.

Self-control and performance were assessed by asking whether the participant currently had an exercise goal (yes or no). The item was developed from the preliminary focus groups (Rogers et al., 2004).

Observational learning (i.e., role models) was measured by three yes-or-no questions asking about breast cancer exercise role models, with the responses summed for a role model score (i.e., respondent has known a patient with breast cancer who exercised during treatment, benefited from exercise during treatment, or influenced her exercise behavior). The questions were developed specifically for the study (and derived from the focus groups) (Rogers et al., 2004). Role-model responses were dichotomized for analysis as having or not having a role model.

Reinforcement management was measured using four questions previously tested for reliability and validity (i.e., alpha coefficient of 0.80–0.82; significant differences across varying exercise levels) (Marcus, Rossi, Selby, Niaura, & Abrams, 1992). Participants were asked to rate on a 5-point Likert scale the frequency of rewards for exercising (i.e., two items), positive self-talk, and use of realistic achievable goals. The mean of the four questions was used for analysis.

Emotional coping responses were measured using the emotional well-being subscale of the Functional Assessment of Cancer Therapy for Breast Cancer survey, previously tested for reliability and validity among patients with breast cancer (i.e., coefficient alpha of 0.69; significant correlation with the Profile of Mood States Short Form (Yellen, Cella, Webster, Blendowski, & Kaplan, 1997). Six questions ask the frequency of specific emotions (e.g., sadness, worry, etc.) on a 5-point Likert scale. The responses were summed for analysis.

A pilot-tested chart audit form was designed to record the following variables: menopausal status, cancer stage, and treatment type. Body mass index (weight in kilograms divided by height in meters squared) was calculated based on height (self-report) and weight (taken from in medical records). Body mass index was categorized for descriptive purposes but was analyzed as a continuous variable.

Study Procedures

Because the survey required 60 minutes to complete, it was administered in two sections on two separate visits about one month apart. At time of enrollment, section 1 of the survey was administered. Section 1 included demographics, pretreatment physical activity stage of change, barriers, knowledge, counseling, outcome expectations and values, enjoyment, fear, and role models. Section 2 included barrier self-efficacy, task self-efficacy, exercise partner, exercise goal, emotional coping, and reinforcement management. The survey was administered as a structured interview unless time constraints necessitated self-administration.

At the time of administration of section 1 of the survey, participants were given a pedometer and the following instructions: Wear the pedometer attached to the waistband of your clothing about two or three inches from the navel directly above the dominant weight-bearing foot, remove the pedometer during sleep and bathing, and record the total step count at the end of each 24-hour period on a one-page record sheet. Prior to issuing each pedometer, the researchers confirmed accuracy with a 20-step test (Tudor-Locke, 2002). Each participant was instructed to begin pedometer monitoring one week prior to the scheduled appointment for administration of section 2 of the survey.

The seven-day physical activity recall was administered with section 2. If the participant was administered chemotherapy at enrollment, physical activity was measured for the week prior to the next chemotherapy administration (or cycle) after enrollment. Because of the nature of the study setting (i.e., medical oncologists' office), all patients were receiving chemotherapy or hormonal therapy. None of the participants was receiving radiation therapy at enrollment. Chart audit information was collected by trained research staff after completion of section 1 of the survey.

Data Management and Analysis

Data were entered into Excel (Microsoft Corporation, Redmond, WA) and exported to SPSS® version 11.5 (SPSS Inc., Chicago, IL) for analysis. For pedometer readings, the mean for the days provided was calculated to impute missing values (i.e., two participants had two days of missing data, and one participant had three days of missing data). Missing survey items (i.e., one participant omitted one barrier response, and one participant omitted two outcome value responses and one outcome-expectation response) were imputed by multiple linear regression.

Descriptive analyses for variables measured by section 1 of the survey were based on the 21 participants enrolled. Descriptive analyses for the variables measured by section 2 of the survey were based on the 17 participants who completed section 2. Descriptive analyses for pedometer and recall data and the correlation analyses were based on the 15 participants who completed the pedometer monitoring and the 14 participants who completed the seven-day physical activity recall.

To examine the associations between physical activity and potential correlates in the framework of social cognitive theory, energy expenditure (i.e., kcal/kg per day) and average daily steps were treated as dependent variables. The potential correlates related to the constructs of self-efficacy, barriers, partners and role models, prior physical activity counseling, physical activity knowledge, pretreatment physical activity, outcome expectations and values, goals, reinforcement management, and emotional well-being were treated as independent variables. Spearman correlation was performed for ordinal independent variables with Pearson correlation for continuous and dichotomous (i.e., point-biserial) variables. Correlation coefficients were interpreted based on statistical significance or effect sizes given by Cohen (1988). Behavioral medicine investigators recognize the importance of effect sizes as expressed by the magnitude of the correlation coefficient. For example, even when not statistically significant, a correlation coefficient (i.e., *r* value) of 0.30–0.49 represents a “medium” effect size and can be clinically meaningful (Cohen). Because

this was a pilot study with a small sample size, the researchers used the more liberal definition to avoid excluding potentially meaningful correlates warranting further study.

Results

Twenty-one of the 24 eligible patients agreed to participate (88% response rate). Of the 21 patients completing section 1 of the survey, four did not complete section 2 because of voluntary withdrawal (*n* = 3) or development of metastatic disease (*n* = 1). Of the 17 participants completing section 2 of the survey, 1 refused to wear the pedometer and 1 failed to record the daily steps on the record sheet, leaving 15 participants with pedometer data. With regard to the seven-day physical activity recall, 2 of 17 refused to complete the recall and 1 was not administered the recall according to protocol, requiring exclusion of the data, leaving 14 participants with recall data.

Based on the 21 participants enrolled, most participants were Caucasian (90%), with about half (52%) being 50–60 years old. The majority reported more than 12 years of education (67%) and currently were employed (57%), with almost half reporting an annual income level of \$20,000–\$49,999 (43%) or \$50,000 or more (38%). Most participants were postmenopausal (72%). About half (48%) had stage II disease, with the remaining having stage I (28%) or stage III (24%). About half (48%) were receiving chemotherapy at the time of enrollment, with the remaining receiving hormonal therapy. Twenty-four percent were overweight, and 48% were obese (see Table 1).

The mean of daily steps (*n* = 15) was $5,525 \pm 2,906$, and mean energy expenditure (*n* = 14) was 10.3 ± 2.0 kcal/kg per day. On a 5-point Likert scale (1 = not at all confident to 5 = very confident), the mean barrier self-efficacy was 2.5 ± 0.9 and the mean task self-efficacy was 3.1 ± 0.9 (*n* = 17 for both). Based on the 21 participants enrolled, 5 (24%) reported prior physical activity counseling by a physician or nurse, 20 (95%) believed a patient with breast cancer should exercise during treatment, and 3 (14%) reported having a breast cancer exercise role model. About half (*n* = 9, 43%) were physically active before treatment (i.e., action or maintenance stage of change). On a 5-point Likert scale, the mean physical activity enjoyment was 3.7 ± 1.2 and mean physical activity fear was 1.2 ± 0.6 . The mean positive outcome expectations (i.e., benefits) and values (i.e., importance) scores were 53.9 ± 6.8 (possible range = 13–65) and 32.0 ± 4.3 (possible range = 13–39), respectively. The mean negative outcome expectations and values scores were 7.1 ± 2.8 (possible range = 3–15) and 8.3 ± 1.1 (possible range = 3–9), respectively.

Based on the 17 participants completing section 2 of the survey, 4 (24%) reported having an exercise partner and 6 (35%) reported a current exercise goal. The mean barriers score was 63 ± 18.9 , mean reinforcement management score was 2.6 ± 0.8 , and mean emotional well-being score was 18 ± 4.4 . Of the constructs assessed, those with mean scores greater than the possible mid-range included task self-efficacy, physical activity enjoyment, positive expectation score, positive value score, positive outcome-expectancy value, negative value score, total expectation score, total value score, total outcome-expectancy value, and emotional well-being.

Bivariate correlations for physical activity behavior with each social cognitive theory variable and demographics are

Table 1. Demographic and Medical Characteristics

Variable	n	%
Age (years)		
< 50	5	24
50–60	11	52
> 60	5	24
Ethnicity		
Caucasian	19	90
African American	2	10
Education (years)		
< 12	2	9
12	5	24
13–15	9	43
≥ 16	5	24
Yearly income (\$)		
≤ 19,999	3	15
20,000–49,999	9	43
≥ 50,000	8	38
Missing	1	4
Employment status		
Employed	12	57
Not employed	9	43
Cancer stage		
Stage I	6	28
Stage II	10	48
Stage III	5	24
Cancer treatment type at time of enrollment		
Chemotherapy	8	38
Hormonal therapy	11	52
Both	2	10
Menopausal status		
Premenopausal or perimenopausal	6	28
Postmenopausal	15	72
Body mass index		
< 25	6	28
25 to < 30	5	24
≥ 30	10	48

N = 21

Note. Because of rounding, some percentages may not match others with the same n value.

provided in Table 2. A higher average of steps per day was significantly associated with having a patient with breast cancer exercise role model ($r = 0.56$, $p = 0.03$) and higher annual income ($r = 0.61$, $p = 0.02$). Higher daily energy expenditure (i.e., kcal/kg per day) was significantly associated with higher barrier self-efficacy ($r = 0.62$, $p = 0.02$), higher task self-efficacy ($r = 0.77$, $p = 0.001$), having an exercise partner ($r = 0.71$, $p = 0.004$), and having a breast cancer exercise role model ($r = 0.74$, $p = 0.003$). Significant associations also were noted between higher energy expenditure and higher physical activity enjoyment ($r = 0.60$, $p = 0.02$) and lower negative value score ($r = -0.60$, $p = 0.02$). Although not statistically significant, several correlations (i.e., r values) were equal to or greater than 0.3, suggesting a medium or greater effect size (Cohen, 1988). Consideration of all variables with correlations greater than or equal to 0.3 (with or without statistical significance) demonstrated potential correlations with physical activity for all social cognitive theory constructs examined, with the exception of self-control and performance. Lastly, disease- and treatment-specific variables were not significantly correlated with physical activity behavior, although participants with

higher disease stage and on chemotherapy at time of enrollment reported lower energy expenditure ($r = -0.33$, $p = 0.25$ and $r = -0.38$, $p = 0.18$, respectively).

Discussion

Although confirmation in a larger study is needed, the results of this study suggest several conclusions. Among patients with breast cancer during treatment, greater levels of subjective physical activity (i.e., self-report) appear significantly associated with higher barrier and task self-efficacy, presence of an exercise partner, greater physical activity enjoyment, lower negative value score (i.e., less important to the subject to avoid negative exercise outcomes), and exposure to breast cancer exercise role models. Greater levels of objective physical activity (i.e., pedometer) were significantly associated with exposure to role models only.

Although several associations were not statistically significant, the correlation coefficients suggested a medium or greater effect size (i.e., $r \geq 0.3$), warranting further study (Cohen, 1988). Specifically, a medium or greater effect size association was seen between greater physical activity (subjective or objective) and higher pretreatment physical activity, lower perceived barriers, lower physical activity fear, higher positive expectation score (i.e., more expected positive exercise outcomes), higher positive outcome-expectancy score (i.e., both importance and frequency of positive outcomes are greater), higher negative expectation score (i.e., more expected negative exercise outcomes), total outcome-expectancy score (i.e., both positive and negative outcomes are more important), greater use of reinforcement management, and higher emotional well-being. The social cognitive theory constructs provide a useful framework for understanding physical activity among patients with breast cancer during treatment, but the strength of the associations is dependent on type of physical activity measurement used.

Comparison With Prior Studies

Self-efficacy demonstrated strong correlations with physical activity behavior; similar associations have been found consistently in other populations (Troost, Owen, Bauman, Sallis, & Brown, 2002). Among breast cancer survivors (mean months since diagnosis = 23.5), participants complying with a low-fat diet and regular exercise reported higher mean barrier self-efficacy when compared with those not complying with healthy diet and exercise habits (3.27 versus 2.26, $p \leq 0.001$) (Pinto, Maruyama, et al., 2002). Because prior studies have focused primarily on barrier self-efficacy (i.e., overcoming barriers), the current study is unique in its measurement of task self-efficacy (i.e., confidence in ability to perform the constituent components of a task). Task self-efficacy has been studied inadequately and may be important for patients with chronic disease (Blanchard, Rodgers, Courneya, Daub, & Black, 2002). The authors found that task self-efficacy was significantly associated with physical activity among patients with breast cancer during treatment, suggesting task performance as an important aspect of self-efficacy to be considered in future studies related to physical activity among such patients.

Although most of the medium or greater effect associations with physical activity found in the current study have been demonstrated in other selected patient populations (Glanz et

Table 2. Correlates of Physical Activity Among Patients With Breast Cancer During Treatment

Variable	Average Daily Steps (N = 15)	Energy Expenditure ^a (N = 14)
	Correlation Coefficient (p ^b)	Correlation Coefficient (p ^b)
Self-efficacy		
Barrier self-efficacy	0.28 (0.32)	0.62^c (0.02) ^d
Task self-efficacy	0.25 (0.38)	0.77 (0.001) ^d
Environment		
Barriers	-0.29 (0.30)	-0.51 (0.07)
Exercise partner (yes)	0.44 (0.10)	0.71 (0.004) ^d
Physical activity counseling	-0.27 (0.33)	-0.11 (0.70)
Behavioral capability		
Physical activity knowledge	0.20 (0.49)	-0.14 (0.64)
Pretreatment physical activity	0.17 (0.56)	0.43 (0.13)
Expectations and values		
Physical activity enjoyment	0.35 (0.21)	0.60^c (0.02) ^d
Physical activity fear	-0.14 (0.63)	-0.30 (0.29)
Positive expectation score	0.43 (0.11)	0.26 (0.37)
Positive value score	0.10 (0.72)	-0.18 (0.55)
Positive outcome-expectancy value	0.31 (0.26)	0.04 (0.91)
Negative expectation score	0.32 (0.25)	0.43 (0.13)
Negative value score	-0.29 (0.30)	-0.60 (0.02) ^d
Negative outcome-expectancy value	0.15 (0.60)	0.04 (0.91)
Total expectation score	0.26 (0.36)	0.10 (0.74)
Total value score	0.013 (0.96)	-0.30 (0.30)
Total outcome-expectancy value	0.17 (0.54)	-0.12 (0.69)
Self-control and performance		
Current physical activity goal	-0.10 (0.72)	-0.15 (0.60)
Observational learning		
Role model (yes)	0.56 (0.03) ^d	0.74 (0.003) ^d
Reinforcement		
Reinforcement management	0.34 (0.21)	0.28 (0.34)
Emotional coping responses		
Emotional well-being	0.30 (0.27)	0.24 (0.41)
Age	0.30 (0.27)	0.37 (0.20)
Ethnicity	0.20 (0.49)	-0.14 (0.64)
Cancer stage	0.16 (0.58)	-0.33 (0.25)
Chemotherapy at time of enrollment	-0.21 (0.45)	-0.38 (0.18)
Years of education	0.23 (0.42)	0.27 (0.35)
Employed	0.03 (0.92)	-0.37 (0.19)
Annual income	0.61 (0.02)	0.18 (0.53)
Body mass index	-0.37 (0.17)	-0.50 (0.07)

^a Energy expenditure equals kilocalories/kilogram per day based on seven-day physical activity recall.

^b Spearman correlation coefficient for ordinal, Pearson correlation for continuous, and point-biserial correlation for dichotomous independent variables

^c Correlation coefficients in bold font indicate medium or greater effect size associations (i.e., $r \geq 0.30$) (Cohen, 1988).

^d Statistically significant p value < 0.05.

al., 1997; Trost et al., 2002; Williams et al., 2005), comparison of the results to studies among patients with breast cancer is limited by the fact that only two prior studies have evaluated correlates of physical activity during breast cancer treatment (Courneya & Friedenreich, 1999; Rhodes et al., 2001). Neither of the studies specifically evaluated social cognitive theory constructs, used an objective measurement of physical activity, or collected data during treatment (i.e., information was recalled after treatment completed). Only one study used a be-

havioral theory framework with potential overlap with social cognitive theory (Courneya & Friedenreich). Courneya and Friedenreich surveyed 164 patients with breast cancer within two years post-treatment about their exercise attitudes and behaviors during treatment. Based on the theory of planned behavior, intention and perceived behavioral control were significant determinants of exercise, with attitude and subjective norm being significant determinants of intention. Those findings are consistent with the positive association found in the current study between exercise and barrier self-efficacy (i.e., similar to perceived behavior control), outcome expectations and values (i.e., similar to attitude), and exercise partners and role models (i.e., similar to subjective norm).

Research Methodologic Issues

The strength of association between the social cognitive theory constructs was, in general, stronger with the seven-day physical activity recall (i.e., subjective measure of physical activity) than with the pedometer (i.e., objective measure). Similar to the results of the current study, Dishman, Darracott, and Lambert (1992) demonstrated that social cognitive variables explained 26% of the variation in physical activity measured by a seven-day diary but were unrelated to motion sensor counts. The seven-day physical activity recall is a better measure of leisure time physical activity, whereas the pedometer measures free-living physical activity related to walking or jogging. Thus, the social cognitive theory constructs may be most important for engaging in planned physical activity beyond that of everyday activities. Also, participants with generally more positive beliefs about physical activity (e.g., self-efficacy, enjoyment) may tend to overestimate their physical activity when based on self-report.

Consistent with the expectancy value theory, which is a component of social cognitive theory (Bandura, 1986), outcome expectations and values were studied by summing the multiplicative function. This methodology among patients with breast cancer during treatment may obscure the influence of either expectations or values alone. For example, higher negative outcome expectations may be associated with greater physical activity (i.e., positive correlation) because more active individuals have experienced the negative outcomes such as increased joint pain and muscle soreness. Also, those with higher negative outcome values may be less active (i.e., negative correlation) because they want to avoid such outcomes. Creating the multiplicative function (i.e., negative outcome-expectancy value) resulted in a construct that was not associated with physical activity probably because of the influence of combining the positive with the negative association constructs. Similarly, the multiplicative function was found to be inferior for the theory of planned behavior variables (i.e., behavioral, normative, and control beliefs) in the Courneya and Friedenreich (1999) study among patients with breast cancer.

In addition, positive and negative outcome expectations and values had differential associations with physical activity. When compared with values, positive exercise outcome expectations demonstrated greater effects than positive values, yet negative values had similar or greater effects than negative expectations. This suggests the need to study these constructs separately and supports replacing multiplicative function analysis with traditional statistical methods (described by Baron and Kenny [1986]) for testing interaction between expectations and their value to participants (Williams et al., 2005).

Study Limitations

The study is limited by its small sample size, reducing power and precluding subgroup and multivariate analyses. Also, minimal representation of minorities and people of lower socioeconomic status prevents generalization. Lastly, 43% of participants were physically active pretreatment (i.e., action or maintenance exercise stage of change), suggesting the potential for selection bias (i.e., patients more interested in physical activity were more apt to agree to participate). However, the percentage is similar to that reported by Rhodes et al. (2001) (i.e., 42% physically active pretreatment). Although such selection bias interferes with generalization of the prevalence rates related to physical activity behavior to all patients with breast cancer during treatment, it is less likely to negate the validity of the important associations between the social cognitive theory constructs and physical activity behavior demonstrated in the study.

Study Strengths

The study is strengthened by its unique focus on social cognitive theory and physical activity behavior among patients with breast cancer during treatment. Only one study has evaluated barrier self-efficacy among breast cancer survivors (Pinto, Maruyama, et al., 2002), and no study has applied a broader application of social cognitive theory to patients with breast cancer during or after treatment. The current study is further strengthened by the data collection at the time of treatment and not recalled after treatment had been completed. Furthermore, the researchers included an objective measurement of physical activity in addition to the self-report measurement.

Implications for Research

Several implications for future research related to physical activity correlates among patients with breast cancer are suggested by the results. The social cognitive theory constructs and physical activity behavior warrant additional study in this population using larger sample sizes with adequate ethnic and socioeconomic representation. Multivariate analysis is needed to test all social cognitive theory constructs simultaneously to determine the most important constructs. Both barrier and task aspects of self-efficacy should be considered.

When analyzing positive and negative exercise outcome expectations (i.e., expected benefits and risks of exercise) and values (i.e., importance of achieving the benefits or avoiding the risks) as potential physical activity correlates in patients with breast cancer during treatment, the constructs should not be combined for a total expectations score, values score, or outcome-expectancy value.

Physical activity measurements should be appropriate for the outcome of interest. For example, if planned, structured physical activity is required to improve fitness and thus achieve maximum benefit from exercise during treatment, then a measurement reflective of this behavior rather than overall free-living activity is needed. Also, subgroup analysis to evaluate for differences based on other disease-specific variables such as type of treatment and cancer stage should be performed. Finally, prospective studies to elucidate the cause-and-effect relationships among the correlations are needed.

Implications for Interventions

Several implications are suggested with regard to physical activity intervention design for patients with breast cancer during treatment. Such interventions should be based on social cognitive theory, and relevant theory constructs should be evaluated as potential mediators or moderators in intervention evaluation. Also, low levels of pretreatment physical activity may allow stratification of patients into groups requiring more intensive behavior intervention to encourage regular exercise.

More specifically, barrier self-efficacy could be improved by setting short-term, realistic goals while focusing on barriers experienced by patients with breast cancer during treatment. Task self-efficacy could be addressed by providing adequate supervision and education initially while helping patients set realistic, low-impact, moderate activities that can be increased gradually in frequency, duration, and intensity. Physical activity enjoyment requires that multiple options are available to allow patients to choose those most enjoyable to them. Interventions should use exercise partners and breast cancer exercise role models.

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