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# Development of an Instrument to Measure Adherence to Strength Training in Postmenopausal Breast Cancer Survivors

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**Purpose/Objectives:** To develop a theory-based instrument for assessing barriers and motivators to strength- or weight-training exercise (SWTE) in postmenopausal breast cancer survivors with measurable bone loss after treatment.

**Design:** Exploratory, descriptive, and methodologic.

**Setting:** Academic oncology clinics in the midwestern United States, homes, and a fitness center.

**Sample:** 85 women, predominantly Caucasian (99%), breast cancer survivors, aged 35–75 years, six months after treatment, who were enrolled in a larger study were randomized to receive SWTE; 65 completed the instrument.

**Methods:** Development of a 47-item Likert-type instrument using interviews, contributions from experts, published research, and Self-Efficacy Theory.

**Main Research Variables:** Barriers and motivators of adherence to SWTE.

**Findings:** Four subscales emerged that accounted for 26%–59% of the variance. Factor subscales for barriers were "not prioritizing time for self" and "overcoming other barriers to adherence." Subscales for motivators included "education and feedback" and "social support."

**Conclusions:** The final instrument contained 47 items dispersed across four subscales. Additional psychometric testing of the instrument with a larger population is indicated.

**Implications for Nursing:** Nurses and healthcare professionals may use the instrument to readily identify barriers and motivators to SWTE adherence to improve program design and implementation efforts aimed at facilitating enhanced exercise adherence in breast cancer survivors with measurable bone loss after treatment.

As treatments improve, a greater number of patients with breast cancer will survive their cancer (American Cancer Society [ACS], 2007). In 1975, the survival rate for breast cancer in women was 75%; in 2007, it was 89% (ACS). Although survival rates continue to increase, breast cancer survivors are at increased risk for osteoporosis and decreased quality of life compared to healthy women (Van Poznak & Sauter, 2005). Osteoporosis and osteopenia affect up to 11% and 67%, respectively, of breast cancer survivors (Gross, Ott, Lindsey, Twiss, & Waltman, 2002). The increased risk for osteoporosis in breast cancer survivors is caused by early ovarian failure or menopause with cancer chemotherapy as well as treatment with glucocorticoids, aromatase inhibitors, and bone-wasting agents such as doxorubicin, cyclophosphamide, and methotrexate (Schwartz, Winters-Stone, & Galluci, 2007). In addition, breast cancer survivors are not candidates for hormone replacement therapy (HRT) because of concerns about cancer recurrence with administration of estrogen (Baber, Hickey, & Kwik, 2005).

Osteoporosis is a serious and potentially life-threatening condition, with complications including skeletal fractures, impaired daily function, and decreased quality of life (Siris et al., 2001). Studies have documented that exercise and nutritional and pharmaceutical interventions can be effective in preventing and treating osteoporosis in breast cancer survivors (Burnham & Wilcox, 2002; Schwartz et al., 2007). Exercise programming prescribed by healthcare professionals for postmenopausal breast cancer survivors varies with stage of recovery and from individual to individual and may include range of motion activities, balance routines, aerobic exercise, resistance exercises, or any combination of these (Fairey et al., 2003; Waltman et al., 2003). Reported benefits of exercise in these women include aerobic fitness, increased muscle strength and bone mass, increased physical functioning, increased quality of life, and decreased

fatigue, depression, and anxiety (Irwin & Ainsworth, 2004; McNeely, Campbell, et al., 2006; McNeely, Peddle, Parliament, & Courneya, 2006; Ohira, Schmitz, Ahmed, & Yee, 2006).

According to the American College of Sports Medicine ([ACSM], 2006), to achieve the health benefits of resistance training, participation should include a minimum of two days per week, at least one set of 8–12 repetitions, using 6–10 exercises that incorporate the major muscle groups (Kraemer et al., 2002). The literature is inconclusive about what constitutes adherence; however, exercisers who maintain the ACSM recommendation for resistance training longer than six months would typically be considered as maintaining exercise behavior (ACSM; Prochaska & Velicer, 1997; White, Ransdell, Vener, & Flohr, 2005). Unfortunately, exercise program adherence rates are alarmingly low. About 50% of healthy adult women who begin an exercise program quit after six months (Ainsworth, 2000; Dishman & Buckworth, 1996). Adherence rates in cancer survivors have been reported to vary from 98% for patients with cancer who are engaged in formal exercise programming to as low as 16% for cancer survivors who are not engaged in formal programs (McNeely, Cambell, et al., 2006).

Adherence to exercise for breast cancer survivors may be particularly problematic. Unique aspects of this population can deter exercise participation (e.g., type of treatment, side effects, stage of recovery, pain, fatigue, sleep disturbances, lymphedema). Qualitative studies report time and guilt as predominant barriers to exercise participation in healthy women (Eyler & Vest, 2002). In a study by White et al. (2005), healthy women who adhered to physical activity one to three years after an exercise program was completed reported prioritizing time for themselves, whereas women who were not adhering reported a number of barriers that kept them from prioritizing time for themselves. Motivation, knowledge, support, fear of injury, and lack of financial resources are other barriers to exercise that have been reported by women (Eyler et al., 2002). Additional factors related to exercise adherence in healthy women include social support (support from a healthcare professional), education, and behavior change strategies (Trost, Owen, Bauman, Sallis, & Brown, 2002; White et al.). Similar findings have been reported in patients with cancer; however, additional factors including nausea and fatigue also have been reported, particularly in populations receiving treatment for cancer (Coleman, Hall-Barrow, Coon, & Stewart, 2003; Pickett et al., 2002; Rogers et al., 2005). Research findings on adherence factors specific to breast cancer survivors vary and are difficult to interpret because of a paucity of research, considerable variability in study designs and subject population (stage of treatment, age, and ethnicity), and variations in exercise program design (e.g., frequency, intensity, mode, duration, setting, supervision). In addition, although healthy women and breast cancer survivors appear to share common barriers to exercise adherence, the relative importance of these factors in breast cancer survivors remains unclear.

Typically the mode of exercise prescribed for enhancing bone mineral density is resistance training. Resistance exercise training is an effective countermeasure to bone loss in postmenopausal women; however, few studies have examined factors associated with adherence to these programs in breast cancer survivors (Daley, Crank, Mutrie, Saxton, & Coleman, 2007; Kerr, Morton, Dick, & Prince, 1996; Nelson et al., 1994; Taaffe, Pruitt, Pyka, Guido, & Marcus, 1996). Most of the studies to assess determinants of exercise adherence reported in the literature are related to cardiovascular exercise (Daley et al., 2007; Milne, Wallman, Gordon, & Courneya, 2007). Moreover, the use of valid and reliable instruments to assess these factors has been inconsistent, partially because of the limited availability of resources and tools in this area.

To increase adherence to exercise programs in breast cancer survivors, researchers must identify factors related to adherence. One of the most common factors in all populations is self-efficacy (Bandura, 1997; Jones, Harris, Waller, & Coggins, 2005; McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003). According to Bandura's (1997) Self-Efficacy Theory, a person is more likely to be adherent to exercise programs when they have confidence in their ability to accomplish the behavior changes necessary for adherence to the programs. Bandura (1997) proposed that determining whether or not a person will participate in a behavior includes the individual's capability to symbolize the meanings of behavior, to foresee the outcomes of given behavior patterns, to learn by observing others, to self-determine or self-regulate behavior, and to reflect and analyze experiences. Bandura (1997) described "situational, social, and personal hindrances that interfere with exercise efficacy" (p. 285), "the need for support to weather adversities" (p. 293), and the importance of "persuasive influences that contribute to staying power" (p. 288). These factors influence an individual's self-efficacy or judgment of their capability to participate in a specific behavior and provide insight into perceived barriers and motivators of exercise adherence.

Enhanced self-efficacy has been shown to increase exercise adherence (Brassington, Atienza, Perczek, DiLorenzo, & King, 2002; Oman & King, 1998; Wilbur, Michaels, Chandler, & McDevitt, 2003). These researchers demonstrated that, with continued exercise participation, self-efficacy and adherence increase concurrently (Brassington et al.; McAuley, Mihalko, & Bane, 1997; Oman & King). Wilbur et al. illustrated that women who have high self-efficacy when they begin a home-based physical activity program may have greater adherence to the program over six months. However, the relationship between self-efficacy and exercise may be more complex in breast cancer survivors. Ott et al.

(2004) studied postmenopausal breast cancer survivors with osteoporosis engaged in home-based strength- or weight-based training (SWTE) and reported greater than 94% adherence over six months. Scores for self-efficacy were high from the beginning to the end of the study but did not change significantly over the course of the investigation. These researchers suggested that behavioral strategies to educate participants about their disease and the benefit of regular exercise may have been instrumental in raising adherence in this population. Limitations in available valid and reliable instruments to assess factors related to adherence in this group were noted.

The purpose of this study was to develop a theory-based instrument to assess factors influencing adherence to SWTE programs in postmenopausal breast cancer survivors with bone loss. Items in the instrument were developed using data collected from interviews with postmenopausal breast cancer survivors in SWTE programs, from experts in the field (PhD faculty with expertise in exercise interventions), published research findings on exercise adherence, and factors influencing exercise adherence as described by Bandura's (1997) Self-Efficacy Theory.

## Methods

An instrument to assess factors related to adherence to SWTE was developed using a sample of 85 women randomly assigned to the SWTE group of a larger study entitled Prevention and Treatment of Osteoporosis in Breast Cancer Survivors. The purpose of the larger study was to test whether a 24-month SWTE intervention enhanced the effectiveness of risedronate (a bone-building medication), calcium, and vitamin D in improving bone mineral density (BMD) in postmenopausal breast cancer survivors who had either osteopenia or osteoporosis (Waltman et al., 2008).

### Sample for Testing Instrument

In the larger study, 223 breast cancer survivors completed the 24-month intervention, and 110 of the 223 women had been randomized to the SWTE group. At the time of instrument development, 85 of the 110 breast cancer survivors in the SWTE group who were less than 90% adherent to the 24-month SWTE intervention and who had completed at least 12 months of the intervention (i.e., two times weekly totaling 104 sessions) were asked to complete the instrument. All women resided within a 100-mile radius of four sites across Nebraska (Omaha, Lincoln, Kearney, and Scottsbluff). Eligibility criteria for participants included being at least six months after treatment (for stages I, II, or IIIa breast cancer), at least six months postmenopausal, having measurable bone loss (osteopenia or osteoporosis), aged 35–75 years, and able to read and understand English. Women were excluded from this study if they had a body mass index (BMI) greater than 35, performed SWTE at time of enrollment in the study, or had concomitant conditions prohibiting exercise. Additional exclusion criteria included HRT, recurrence of breast cancer, severe renal insufficiency, and active gastrointestinal issues. The instrument was completed by 65 of the 85 women (76%).

### Development of Items for Instrument

Potential items for the instrument were developed from SWTE groups' self-reports of reasons why they were or were not adherent to exercises (as documented in research nurse interviews in the larger study), from a literature review, and from Bandura's (1997) Self-Efficacy Theory. Four doctorally-prepared faculty members with expertise in exercise for postmenopausal women were asked to document content validity of potential items. They were asked to categorize items as barriers or motivators to adherence to exercise and rate on a scale of 1–5 whether they strongly disagreed, disagreed, had no opinion, agreed, or strongly agreed that this item was important to adherence or nonadherence to exercise. Items with mean scores above 4 were included in the instrument in sections on "barriers" and "motivators."

The final 59-item questionnaire that was mailed to the 85 subjects was divided into two sections. In the first section (items 1–19), women were to rate on a scale of 1 (strongly disagree) to 5 (strongly agree) whether the item was a barrier to their exercise adherence. Examples included lack of confidence, did not believe exercise was important for health, exercise became boring, exercise was not a priority, family and friends were more important, and family and friends interfered. As stated by Bandura (1997), barriers such as lack of confidence (self-efficacy), a lack of understanding of the meaning of the behavior (importance of outcomes), and lack of support may negatively influence an individual's self-efficacy or judgment of their capability to participate in a specific behavior. In the second section (items 20–59), women rated on a scale of 1 (not important) to 5 (very important) the importance of potential motivators in influencing their adherence to exercise. Examples included self-monitoring their exercise in a journal, feedback on expected outcomes of exercise (bone mineral density, exercise performance, blood work), encouragement from nurse or exercise trainer, and encouragement from family and friends. Bandura (1997) stated that people must seek external support and resources because they do not necessarily develop their knowledge and their cognitive competencies entirely by themselves. This feedback and encouragement may influence participation in physical activity behavior.

### Recruitment of Sample and Data Collection

Approval was obtained from the medical center institutional review board before this study was

implemented. The research nurses phoned each of the eligible 85 women and asked them if they would agree to complete a questionnaire on barriers and motivators for adherence to the exercise program. Women were informed that completion of the questionnaire was voluntary and their decision to complete or not complete the questionnaire would not affect their relationship with the investigators in the larger study or their care at the medical center. If they agreed to participate, they were mailed a stamped, self-addressed envelope along with the questionnaire and were asked to return the completed questionnaire within two weeks. Completed questionnaires were identified only by coded identification numbers and were stored in locked files. Individual identity of the subjects was kept confidential.

### Determination of Content Validity for Questionnaire

Content validity of the instrument's items was evaluated according to Lynn's (1986) Content Validation Procedure using a two-stage process of development and judgment. Based on the interviews, literature, and theory, four domains were identified and items were generated for each identified domain. In the third step, the items were refined and the questionnaire was assembled.

### Construct Validity and Reliability Testing of the Instrument

Factor analysis was used to identify sets of items that grouped together (i.e., measured the same construct). Developing reasonable interpretations for those sets of items that group together is a common use of the factor analysis results, primarily because it can help to determine what construct is being measured in each of the sets of items (Johnson & Tsui, 1998). In this current study, two factor analyses, one on each section of the instrument (barriers to adherence and motivators for adherence) were conducted. Conducting separate factor analyses on each section was considered preferable to one overall analysis for theoretical and statistical reasons. Pedhazur and Schmelkin (1991) suggested that a minimum of 50 subjects per factor is needed for adequate statistical power. Because each section was suspected to be comprised of more than one factor, an overall factor analysis on the entire instrument would likely be underpowered. This restraint contributed to the decision to construct a separate factor analyses on each section.

When the factor analysis results were obtained, the emerging factors were identified and information from the factor loadings as well as congruence with Bandura's (1997) Self-Efficacy Theory were used to create meaningful subscales. Reliability and factor analyses results were used to identify misbehaving items to be considered for removal from each of the subscales. If the removal of a misbehaving item from a subscale was acceptable from a theoretical perspective, the item was removed. This process was repeated on each item in question until a final set of items was reached. A total of 12 items were removed. Cronbach coefficient alpha was calculated as in index of internal consistency for each subscale. The final instrument consisted of 47 items that formed four subscales.

## Results

Demographics for the 85 women asked to complete the instrument are summarized in Table 1. The factor analysis results for section one (barriers to adherence) indicated a two-factor solution. The first two factors (Eigen values: 4.27, 2.45) accounted for 37% of the total variance, and additional examination of the factor loadings, using a varimax rotation to aid interpretability, helped to identify the factors. The two factor subscales that emerged as barriers to adherence were inability to "prioritize time for self" (five items) and inability to "overcome other barriers to exercises" (nine items). The factor analysis results for section two (motivators for adherence) also indicated a two-factor solution. The first two factors (Eigen values: 9.07, 4.02) accounted for 35% of the total variance. Additional examination of the factor loadings, again using a varimax rotation, identified two factor subscales that emerged as motivators for adherence including "education and feedback" (14 items) and "social support for exercises" (nine items).

**Table 1. Demographic Characteristics of Breast Cancer Survivors Who Are 90% or Less Adherent to Strength- or Weight-Training Exercise**

| Characteristic | $\bar{X}$ | SD |
|---|---|---|
| Age (years) | 59.08 | 7.02 |
| Time since menopause or hormone replacement therapy (years) | 7.04 | 7.16 |
| Time since breast cancer treatment (years) | 5.64 | 6.2 |
| Body mass index | 26.69 | 3.98 |
| **Characteristic** | **n** | **%** |
| **Race or ethnicity** | | |
| Non-Hispanic Caucasian | 84 | 99 |
| African American | 1 | 1 |
| **Family history of osteoporosis** | | |
| Yes | 25 | 29 |
| No | 60 | 71 |
| **Breast cancer treatment** | | |
| Had surgery | 83 | 98 |
| Had radiation therapy | 52 | 61 |
| Had chemotherapy | 78 | 69 |
| History of lymphedema in arm | 20 | 24 |
| Currently smoking cigarettes | 2 | 2 |

N = 85

**Table 2. Barriers in the "Not Prioritizing Time for Self" Subscale**

| Item | Factor Loading |
|---|---|
| Family and work needs interfered with time to exercise. | 0.85 |
| Not enough time to exercise | 0.83 |
| Family needs are more important than own needs. | 0.78 |
| Exercises not a priority | 0.65 |
| Two times weekly is too often to exercise. | 0.34 |

*Note.* Eigen value is 2.94, total variance is 59%, and reliability (Cronbach alpha) is 0.82.

After the four subscales were finalized, individual factor analyses were performed to assess the dimensionality of each scale. The analysis of the "not prioritizing time for self" scale revealed a one-factor solution (Eigen value: 2.94) that explained 59% of the total variance (see Table 2). Analysis of the "overcoming other barriers to adherence" scale revealed a one-factor solution (Eigen value: 2.94) that explained 33% of the total variance (see Table 3). The "education and feedback" scale also appeared to be unidimensional (Eigen value: 4.81), with 34% of the total variance explained (see Table 4). The "social support for exercise" scale appeared to be unidimensional (Eigen value: 4.92), with 26% of the total variance explained, but one item thought to belong in this scale—item 32: "encouragement and support from family and friends"—failed to cluster with the rest of the items in this scale (see Table 5). Because of its theoretical relationship to the construct being measured by this scale, however, the item was not removed. This is noted because the factor loading for that particular item was much smaller than anticipated.

Reliability was evidenced by Cronbach alpha coefficients of 0.82, 0.7, 0.82, and 0.81 for not prioritizing time for self, overcoming other barriers to adherence, education and feedback, and social support, respectively, suggesting acceptable internal consistency for the four subscales reported here.

### Scoring of Instrument Subscale

Total scores were calculated using the sum of the Likert scores for each item in a given subscale for each person. These total subscale scores were then treated as overall measures of the subscales. Total scores for subscale 1, "not prioritizing time for self," ranged from 5–25, and total scores for subscale 2, "overcoming other barriers to adherence," ranged from 9–45. Subjects who scored higher on these subscales would likely benefit from strategies for reducing these barriers to exercising. For example, subjects who scored high on "not prioritizing time for self" might benefit from assistance in priority-setting and time management. Total scores for subscale 3, "education and feedback," ranged from 14–70, and total scores on subscale 4, "social support," ranged from 19–95. Higher scores on these subscales indicated that an individual considered the factor to be more influential as a barrier or promoter to adherence; therefore, the individual would be more likely to benefit from facilitative strategies that address the factor (i.e., incorporating education, feedback, and social support for exercise). Total subscale scores, as well as ratings for individual items, could be used to identify specific strategies for promoting adherence to specific subject needs.

## Discussion

The purpose of this research was to develop an instrument to assess barriers and motivators to adherence to a SWTE intervention in postmenopausal breast cancer survivors with bone loss. Few tools exist for this purpose and additional research aimed at identifying determinants of adherence in breast cancer survivor populations is warranted (Daley et al., 2007). Determination of key factors related to exercise adherence may be used by clinicians to promote adherence to exercise programs in breast cancer survivors. In the current study, the authors described the development of an instrument to assess barriers and promoters of adherence to a SWTE intervention aimed at decreasing risk for or treatment of osteoporosis in breast cancer survivors.

Factor subscales identified in this study are consistent with findings reported in populations of healthy women and patients with cancer attempting to adhere to exercise (Coleman et al., 2003; Eyler & Vest, 2002; Pickett et al., 2002; Rogers et al., 2005; Trost et al., 2002; White et al., 2005). Two distinct factor subscales (not prioritizing time for self and overcoming other barriers to adherence) were identified as "barriers to adherence," and these subscales accounted for 37% of the total variance. Similarly, two distinct factor subscales were identified

**Table 3. Barriers in the "Overcoming Other Barriers to Adherence" Subscale**

| Item | Factor Loading |
|---|---|
| Wasn't comfortable exercising at fitness center | 0.71 |
| Preferred aerobic to strength and weight training | 0.62 |
| Lacked confidence in how to do exercises | 0.55 |
| Lived too many miles from fitness center | 0.51 |
| Didn't believe exercise is that important for health | 0.48 |
| Preferred home-based exercise to fitness center | 0.45 |
| Exercises became boring. | 0.41 |
| Side effects prevented exercise. | 0.37 |
| Too tired to exercise | 0.23 |

*Note.* Eigen value is 2.94, total variance is 33%, and reliability (Cronbach alpha) is 0.7.

as "motivators for adherence" (education and feedback, and social support) that accounted for 35% of the total variance. Common responses associated with prioritizing time and overcoming barriers included, "family needs more important than own needs," "family and work needs interfered with time to exercise," and "not enough time to exercise." Common responses associated with education, feedback, and support included, "feedback on BMD results," "feedback on muscle strength or balance tests," "feedback on bone turnover markers," "lacked confidence in how to do exercises," and "wasn't comfortable exercising at fitness center."

The general findings that prioritizing time, overcoming barriers, education, feedback, and social support are associated with exercise adherence are consistent with factors related to adherence as identified by Bandura (1997) and with previous research conducted in healthy women. In breast cancer survivors receiving treatment, Rogers et al. (2005), using Social Cognitive Theory constructs (Bandura, 1986), reported that subtypes of self-efficacy, including task self-efficacy (confidence in one's ability to complete constituent components of a task) and barrier self-efficacy (confidence in one's ability to overcome barriers related to the task), were significantly correlated with physical activity (daily caloric expenditure as measured by seven-day recall). Common barriers to physical activity in this group included nausea and fatigue. Having an exercise partner and a breast cancer exercise role model were positively correlated with physical activity in this group. Nausea and fatigue are more common during cancer treatment but are not commonly reported as barriers among breast cancer survivors after treatment or healthy women attempting to engage in regular exercise (Rogers et al.). In the instrument developed in this current study, nausea and fatigue were represented under the subscale "overcoming other barriers to adherence" as "side effects prevented exercise" and "too tired to exercise" and loaded at 0.37 and 0.23, respectively.

**Table 4. Motivation Factors From the "Education and Feedback" Subscale**

| Item | Factor Loading |
|---|---|
| Feedback on muscle strength or balance tests | 0.91 |
| Feedback on bone mineral density results | 0.85 |
| Feedback on bone turnover markers | 0.73 |
| Demonstration of exercises | 0.61 |
| Keeping exercise journal | 0.61 |
| Feedback on performance of exercises | 0.6 |
| Management of symptoms | 0.49 |
| Feedback on positive results of exercises | 0.49 |
| Education on osteoporosis | 0.44 |
| Monthly and bimonthly newsletters | 0.4 |
| Emphasis on benefits of exercise | 0.33 |
| Emphasis on seriousness of diagnosis of osteoporosis | 0.25 |
| Importance of frequent exercise sessions | 0.22 |
| Variation in exercises | 0.14 |

*Note.* Eigen value is 4.81, total variance is 34%, and reliability (Cronbach alpha) is 0.82.

**Table 5. Motivation Factors From the "Social Support" Subscale**

| Item | Factor Loading |
|---|---|
| Phone contacts by exercise trainer | 0.67 |
| More visits from research nurse | 0.61 |
| Receiving rewards or recognition for reaching exercise goals | 0.58 |
| Home visits by exercise trainer | 0.55 |
| Healthcare providers recommending exercises | 0.54 |
| Weekly/monthly support groups | 0.53 |
| Encouragement and support from exercise trainer | 0.53 |
| Support groups for women who exercise | 0.52 |
| Fitness centers closer to home | 0.52 |
| More visits from exercise trainer | 0.48 |
| Fitness centers more supportive of older women | 0.47 |
| Home visits by research nurse | 0.46 |
| Encouragement and support from research nurse | 0.46 |
| Phone contacts by research nurse | 0.39 |
| Chatroom on Internet for women who exercise | 0.32 |
| Exercises tailored to individual needs of women | 0.3 |
| Encouragement and support from staff at fitness center | 0.26 |
| Have women choose exercise partner | 0.22 |
| Encouragement and support from family and friends | 0.01 |

*Note.* Eigen value is 4.92, total variance is 26%, and reliability (Cronbach alpha) is 0.81.

Using the Theory of Planned Behavior Applications, Courneya, Blanchard, and Laing (2001) studied determinants of exercise adherence in a small group of breast cancer survivors engaged in competitive dragon boat racing training. Dragon boat racing involves predominantly intense training, and the generalizability of the study's findings to the broader breast cancer survivor population may be limited. Beliefs related to exercise adherence in this group included confidence in one's ability to exercise with limited time, lack of exercise partners, fatigue, and health issues (control beliefs), as well as support networks such as physicians, spouses, and friends (normative beliefs). Each of these factors was included in the instrument developed in this current article. For example, items related to self-confidence and time were included in subscales "not prioritizing time for self" (not enough time to exercise) and "overcoming other barriers to adherence" (lacked confidence in how to do exercises).

Additional work by Pickett et al. (2002) supported findings reported here. Information (i.e., education) and support were key factors that enhanced exercise adherence in breast cancer survivors receiving cancer treatment. Additional findings from this work indicate that a history of exercise adherence prior to cancer diagnosis may be

an important factor in exercise adherence among breast cancer survivors receiving therapy. The instrument studied here did not include this variable among the items retained for the final questionnaire. Additional research should be aimed at developing additional items for the instrument that are related to previous exercise history.

## Conclusion

A variety of social cognitive models exist that may be useful in exercise programming and adherence promotion. In light of the literature reviewed here, different models clearly use different language and terminology to describe similar concepts. For example "lack of time" and "prioritizing time for self" may be similar barriers in the context of exercise participation.

Exercise programming should be formulated in the context of effective behavior theory, but practitioners should present programming and assessment in user-friendly, population-specific formats (i.e., terminology that participants understand and use). The fundamental design of the instrument described in this research was based on constructs described in Bandura's (1997) Self-Efficacy Theory, whereas specific content was selected based upon interviews with breast cancer survivors that linked potential breast cancer survivors' adherence factors with the Self-Efficacy Theory, input from experts in the field, and published research in the area of factors related to exercise adherence in women. The instrument also was tailored toward breast cancer survivors after treatment by including items that represent relevant concerns for exercise in this population.

Although the study is part of an ongoing long-term investigation that is grounded in behavior theory and applied aspects of disease management and physical activity promotion (key strengths), the study is limited by the small size of the population studied and limited generalizability. Findings from research conducted on patients with multiple myeloma receiving cancer treatment suggest that other cancer groups share similar exercise adherence factors. Coleman et al. (2003) reported beneficial effects from participation in aerobic and strength training programs in patients with multiple myeloma receiving cancer therapy. Facilitative factors related to exercise adherence in this population were similar to those reported for breast cancer survivors and healthy women, including individualized flexible programming and encouragement and support from family, friends, and practitioners. The findings suggest that minimal modifications to the current instrument may be indicated to accommodate additional cancer populations. The findings presented here may be generalized to postmenopausal breast cancer survivors with osteopenia or osteoporosis after treatment and who are engaged in SWTE.

Although the instrument shows potential for validation in this population, the research has several limitations. Additional prospective studies are needed to document whether subjects' scores on subscales are related to their current or future adherence to prescriptions for exercise. If scores are related to adherence to exercises, this instrument could be used to identify subjects who are at risk for nonadherence and in need of strategies promoting adherence. Total subscale scores and ratings on individual items in the instrument could be used to tailor strategies to specific subject needs.

Initial assessments conducted during the development of the 47-item instrument suggest that its psychometric properties show potential for validation in this population. Upon validation, use of this instrument may help practitioners in developing strategies to enhance adherence to exercise programs.

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