DETERMINANTS OF EXERCISE FOR BREAST CANCER SURVIVORS IN TAIWAN

by

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" Do not underestimate your ability; everyone has unlimited potential."

- Master Cheng Yen

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Abstract

DETERMINANTS OF EXERCISE FOR BREAST CANCER SURVIVORS IN TAIWAN

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This is the first study in Taiwan to report the complex nature of the factors that influence exercise behavior among breast cancer survivors and demonstrate cross-culture applicability of the instruments. The proposed model was developed based on Social Cognitive Theory. The natural progression of exercise participation over 6 months after completion of adjuvant treatment was observed to examine the relationship between those factors and exercise behavior among 196 women with stage 0-III breast cancer, ranged in age from 23 to 74 years with mean age 47.63 ± 9.91 years. Age, education, exercise history, cancer-related fatigue, physical health, mental health, social support for exercise, exercise barriers, outcome expectancy, self-efficacy expectancy were selected for their potential contributions to exercise behavior. No treatment or intervention was offered to the participants.

Results indicated that women did increase their exercise participation over time and that overall amount and intensity of exercise participation were below recommended guidelines. At baseline, limited amounts of the total variance in exercise frequency were explained (Multiple R^2 =.29, $F_{12, 181}$= 6.15, $p< .001$). Exercise frequency was significantly predicted by age ($\beta = .72$), education (β

= .74), exercise history (β= .52), social support for exercise (β= .26), exercise self-efficacy (β= .37), and two significant interactions between exercise history and exercise self-efficacy ($F_{1,181}$= 12.21, sr^2=.048, p=.001), and between age and education ($F_{1,181}$= 4.301, sr^2=.017, p=.039). Surprisingly, exercise outcome expectancy did not predict exercise frequency (p= .288).

For change over time, the overall change of exercise self-efficacy was not significant, but exercise outcome expectancy (p=.038) and exercise frequency (p=.001) revealed significant changes over 6 months. Baseline physical health and social support made a significant contribution to explaining the variance of the change in exercise outcome expectancy from baseline to 3 months later. Baseline age, mental health, exercise barriers, social support for exercise, exercise outcome expectancy made a significant contribution to explaining the variance in exercise frequency change over 6 months. The findings partially supported the proposed model. Research implications, limitations and future directions were discussed. The findings from this study would contribute significantly to the literature on psychosocial and exercise aspects of breast cancer survivors in Taiwan.

Marylin J. Dodd RN, PhD, FAAN

Chair, Dissertation Committee

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CHAPTER I

Introduction

Once a virtual death sentence, breast cancer today is a curable disease. Exercise has emerged as an important quality of life intervention for breast caner patients and survivors (Courneya et al., 2003; Pinto, Trunzo, Reiss, & Shiu, 2002; Segal et al., 2001). Research has provided preliminary evidence for the safety, feasibility, and efficacy of exercise training in breast cancer survivors (Courneya et al., 2003). However, the benefits of exercise can only be realized through regular participation. There is a great need to make exercise programs more widely available and to integrate them into the secondary prevention of rehabilitation care for breast cancer survivors. Therefore, the purposes of this research was to examine the trends in exercise participation, to report the complex nature of the factors that influence exercise behavior and to demonstrate cross-culture applicability of the instruments among breast cancer survivors over 6 months after adjuvant treatment was completed. Preliminary results from the present study could assist both researchers and health care providers in helping breast cancer survivors increase their exercise involvement and provide a better quality of life.

According to the Department of Health's Cancer Registry Annual Report, breast cancer is the second leading cancer in Taiwanese women. 4405 Taiwanese women were diagnosed in 1999, and 1082 women died from breast cancer (Department of Health Executive Yuan., 2003). Relative 5 year survival rates for those women diagnosed as early-stage breast cancer are high. Cheng and colleagues (2000) investigated 811 consecutive patients with 830 newly diagnosed breast cancers having their primary treatments at National Taiwan University Hospital between April 1990 and December 1997. Sixty-three percent of breast cancer patients were premenopausal. The early-onset breast cancer (age$\leqq$40) composed 29.3% of all patients. The five-year survival rate of all patients was 80.4% (95% confidence interval [CI], 76.2-84.6%). The five-year overall survival rate for stage 0 was 95.7%, stage I was 93.9%, stage II was 88.5%, stage III was 65.0%, and stage IV was 18.5% (Cheng et al., 2000). The incidence of breast cancer increased from 5.94 cases to 30.45 cases per 100,000 women from 1979 to 1997 (Breast Cancer Research and Treatment, 2000) and the increasing rate is higher than other types of cancer (Lee, Chung, Chao, & Ku, 2001). Factors, such as a stressful life, advances in techniques for early detection, rich high-caloric diet, increased use of oral contraceptives, more women who have their first child late or enjoy single life, may have contributed to increasing incidence rate of breast cancer in women in Taiwan (Formosan Medical Association, 1997).

With the increasing efficacy of surgical mastectomy and medical treatment, an increasing number of cancer survivors are living with long-term effects of disease and treatment that diminish their quality of life. Cancer-related fatigue (CRF) has been recognized as an almost universal side effect of breast cancer and cancer treatment (Portenoy & Itri, 1999) and knowledge about CRF as an long-term sequelae of treatment for breast cancer survivors is scant. CRF is regarded as having its potential detrimental effect on breast cancer patients' well being. The role of CRF in the daily functioning and quality of life of cancer patients has long been ignored. The effective management of CRF can help women with breast cancer focus on physiological and psychosociological healing. Exercise is one of the few interventions suggested to prevent or alleviate CRF in breast cancer patients (McArdle, 2000; Pinto & Maruyama, 1999). The low-risk, low-cost exercise program can be quickly and easily taught by healthcare providers. In Taiwan, unfortunately, exercise is not popular among healthy adults (Huang, 1991; Kao & Huang, 2000; Liu, 1996) and there is no information regarding exercise behavior among cancer population.

To date, limited information is available concerning the determinants of exercise for cancer patients in U.S.A. Moreover, there is no information about motives for participation in exercise for cancer patients in Taiwan. It is important to identify major determinants of exercise for cancer patients in Taiwan and develop theoretical models to direct intervention research.

Social Cognitive Theory (SCT) (Bandura, 1986) has received empirical attention to date relative to exercise behavior. Researchers exploring how individuals come to adopt and maintain exercise have found some success by examining exercise behavior through SCT. SCT is a useful theory to understand exercise behavior and has been tested in cardiovascular and elder populations and it provides the conceptual basis for the proposed study. SCT addresses both the psychosocial dynamics that influence health behaviors and the methods of promoting behavioral change (Glanz, 1997). It is based on an interactional model of human behavior which proposes the principle of triadic reciprocity. This principle states that environmental events, inner personal factors, and behavior are mutually interacting influences (Bandura, 1986). Behavior is influenced by three self-regulation mechanisms operating in concert: perceived self-efficacy for outcome attainment, outcome expectations, and personal goal setting. The theory emphasizes that individuals are agents proactively engaged in their own development and cognition plays a critical role in people's capability to perform behaviors (Bandura, 1986). Most models of health behavior are mainly concerned with predicting health habits, but offer little guidance on how to change these habits. However, SCT provides a unified conceptual framework which embeds the sociocognitive determinants within a large body of knowledge that specifies their origins, the processes through which they produce their effects, and ways to modify them for the enhancement of healthy behavior. The propositions of SCT are logically presented and a systematic linkage exists between the theory's concepts. The internal logic and interconnectedness of this theory is well-established in western culture. Application of the theory is likely to improve researchers' and health professionals' understanding and provide appropriate intervention strategies among patients with breast cancer to increase their exercise behavior.

Theoretical Framework

Social Cognitive Theory

Social Cognitive Theory (SCT) addresses both the psychosocial dynamics influencing health behaviors and the methods of promoting behavioral change (Glanz, 1997). People are regarded as self-organizing, proactive, self-reflecting and self-regulating rather than as passive reactors shaped by environmental events or driven by concealed inner impulses (Bandura, 1986). From this perspective, human functioning is viewed as the product of a dynamic interaction of personal, behavioral, and environmental factors. Therefore, SCT is based on an interactional model of human behavior which proposes the principle of triadic reciprocal causation (Figure 1.1)— environmental events, interpersonal factors and behavior—are mutually continuous and interacting influences (Bandura, 1986). Reciprocity does not mean that the three sets of interacting determinants are of symmetrical strength nor is simultaneous mutual influence in reciprocal causation (Bandura, 1986).

Personal factors of interest in this proposed study that may influence exercise behavior include sociodemographic factors (i.e. age, gender, education, occupation, marital, personality, past exercise history), types of treatment, stages of breast cancer, fatigue, health status, self-efficacy, and outcome expectancy. The term environment refers to an objective notion of all the factors that can affect a person's behavior but that are physically external to that person. Environment can be physical, social, cultural, economical, political or situational.

Environment factors such as social support for exercise (i.e. from family members, friends, peers at work, and health professionals), barriers (i.e. safety of the surrounding environment, time constraints, climate condition and caregiving duties), facilities (i.e. distance, numbers of exercise facilities), or policies (i.e. regulation for promoting exercise, insurance cover age for exercise consulting), may be associated with exercise adoption and maintenance.

Moreover, there has been considerable variation in duration, frequency, intensity, and model of exercise which may affect exercise behavior. A short and less frequent exercise program is not likely to produce changes in functional capacity or alleviate fatigue, which then lowers individual's outcome expectation and motivation to exercise. Most women prefer moderate intensity activities such walking, and they are more likely to maintain such moderate exercise than more vigorous activities (Pinto, Marcus, & Clark, 1996). Although walking and cycling have been the mainstays of the programs offered, these may not be the preferred modes of exercise for all breast cancer survivors. Another issue relating to exercise mode relates to group-based verse individual exercise programs. Some individuals cannot attend group exercise classes or do not prefer this model. The group exercise programs supervised by highly trained medical professionals offer close monitoring of patient's condition but are more expensive.

Rooted within Bandura's social cognitive perspective is the understanding that the nature of a person encompasses certain capabilities- the capabilities to symbolize, plan alternative action (forethought), learn through vicarious experience, self-regulation, and self-reflection (Bandura, 1986). Exercise self-regulation involves skills for planning, organizing, and managing exercise activities (Bandura, 1997). Self-regulation occurs through judgmental processes and through cognitive processing of self-observations (Bandura, 1991). If breast cancer survivors are aware of how their sedentary lifestyle affects their health or the perceived benefits of exercising, they can be guided for exercise participation, anticipate the likely consequences of this action, and develop exercise goals for themselves, and guide and regulate plans that are consistent with their abilities. They can acquire exercise experience simply by watching others and noting the consequences of exercise. Observational learning is often more effective than direct experience. Breast cancer survivors do not have to go through trial and error learning. By watching other patients succeed, they can witness the appropriate level of exercise to achieve the desired result. There is no wasted effort, which is more efficient. Through self-reflection, they make sense of their exercise experiences, evaluate the results, and alter their thinking and sedentary lifestyle accordingly.

Behavior is influenced by three self-regulation mechanisms operating in concert: perceived self-efficacy for outcome attainment, outcome expectations, and personal goal setting (Figure 1.2). Both self-efficacy and outcome expectancy reflect individual beliefs about capabilities and behavior-outcome links. Self-efficacy is defined as a person's belief in his ability to perform a specific behavior which is required to produce an outcome. Self-efficacy is not a measure of skills. Outcome expectancy is the belief that a certain consequence will be produced by performing specific behaviors (Bandura, 1997) (Figure 1.3). Bandura (1977) emphasized that expectation alone will not produce desired performance if the component capabilities are lacking or there is no adequate incentive to change (Bandura, 1977).

Both self-efficacy and outcome expectancy play an influential role in the adoption and maintenance of exercise behavior in breast cancer survivors. A breast cancer survivor may have high self-efficacy for exercise, but if she does not believe the exercise will alleviate fatigue nor improve health and quality of life, or expects to have negative consequences such as worse fatigue (low outcome expectancy to exercise), then it is unlikely that there will be adherence to a regular exercise program. Therefore, the greater the self-efficacy toward participating in exercise, the greater the satisfaction with outcomes of exercise, the greater the adherence exercise behavior performed.

Goals affect self-regulation providing feeling of satisfaction or dissatisfaction with effort. The term 'goal' means intention, task, deadline, purpose, aim, end, and objective. All of these terms have in common the element that there is something that the person wants to achieve (Locke, 1990). For habitual exercise participation, performance is not the only outcome. The participants may be satisfied or dissatisfied with their physical activity participation, or alternatively they may be satisfied or dissatisfied with one or more of outcomes they expect from physical activity participation. Exercise goals may be distal ones (e.g., jog at least 40 miles per month) that serve an orienting function or specific proximal ones that regulate effort and guide action in the here and now (e.g., increase 1 mile of jogging today). Exercise goals provide a means for people to raise or lower their exercise self-efficacy. If exercise goals assigned by others impose constraints and performance burdens, self-efficacy may be lower. Positive rewards from attaining a goal contribute to growth of interest and motivation, and perceived self-efficacy for exercise behavior.

Self-efficacy beliefs vary on three dimensions: level (levels of task demand), generality (a wide range of activities or only in certain domains of functioning), and strength (Bandura, 1997). Consider the measurement of perceived self-efficacy to adherence of an exercise program, individuals judge how well they can get themselves to exercise regularly under various impediments such as stressful work or bad weather. According to SCT theory, breast cancer patients whose self-efficacy for exercise has been raised by success engaging in the exercise program may extend their feelings of self-efficacy to other experiences such as conquering adverse effects of the treatment. Two patients may believe themselves capable of engaging in the exercise but one may hold this belief with more confidence than the other.

Impediments from personal, situational, and the health system form an integral part of self-efficacy assessment. Thus, in assessment of exercise self-efficacy, individuals judge the strength of their capabilities to get themselves to exercise regularly in the face of a variety of personal (e.g., time, child care, work), situational (e.g., weather, access to facilities), and social (e.g., no support) impediments. Efficacy beliefs must be measured against gradations of impediments to successful performance.

Exercise outcome expectations include positive or negative physical and psychological effects, social consequences, and internal self-rewards (Dzewaltowski, 1994). Bandura (1997) clearly defined that "a performance is an accomplishment; an outcome is something that follows from it." (p.22). In short, an outcome is the consequence of exercise participation, not the exercise itself.

SCT emphasizes that individuals are agents proactively engaged in their own development and cognition plays a critical role in people's capability to perform behaviors (Bandura, 1986). The human agent has been not only a planner and fore thinker, but a motivator and self-regulator as well. There are three different modes of human agency: personal, proxy, and collective (Bandura, 2001). Personal agency has direct control over their self-development and life circumstances through cognitive, motivational, affective, and choice processes (Bandura, 1986). Exercise behavior is regulated by cognitive process such as forethought and inferential thinking that embodies valued goals. Motivation is an important contributing factor to activation and persistence of exercise behavior. Bandura (1994) contends that motivation is regulated by causal attributions, expectations, and goal challenges. Perceived self-efficacy affects how much stress and depression patient experience in threatening or difficult situations. People can choose types of exercise and environments that they judge themselves capable of handling (Bandura, 1994). Thus, people with strong self-efficacy set themselves challenging exercise goals and maintain strong commitment to them. They heighten and sustain their efforts in the face of failure. They attribute failure to insufficient effort or deficient exercise knowledge and skills, which are acquirable. They report lower aversive emotional states and regard difficult tasks as challenges to be mastered rather than as threats to be avoided. Highly motivated patients with strong self-efficacy are more likely to choose challenging exercise goals than those with limited motivation and weak self-efficacy.

In contrast, people who have low capabilities have low aspirations and weak commitment to the goals they choose to pursue. When faced with difficult tasks, they dwell on their personal deficiencies rather than concentrate on how to perform successfully. They slacken their efforts and give up quickly in the face of difficulties. They are more vulnerable to anxiety and depression and run away from difficult tasks that they view as personal threats (Bandura, 1997). Self-evaluation affects interpretation of which feelings states are considered positive. It is logical to expect that, when an exercise stimulus regularly induces positive reinforcement immediately after exercise, the likelihood of exercise becoming habitual is increased.

Proxy agency relies on "others to act on one's behest to secure desired outcomes" (Bandura, 2001), p.1), particularly when people do not have direct control over the social conditions that affect their everyday lives. Novice exercisers can obtain exercise self-efficacy by observing other successful cases. Collective agency operates through "socially coordinative and interdependent effort" (Bandura, 2001), p.1) and people work together on shared beliefs about their capabilities and common aspirations to better their lives. The accumulation of successive mastery experiences embodied in activity sessions together acts as a powerful source of efficacy information from groups. The formation of buddy groups may provide a source to share their exercise self-efficacy.

Efficacy belief is a major basis of action. It determines how people feel, think, motivate themselves and behave. This efficacy belief can be developed by four main sources of information: a) enactive mastery experience (personal mastery experience); b) vicarious experience (observation of successful or unsuccessful performance of others); c) verbal persuasion (social persuasion); and d) physiological and affective states associated with the specific behavior (Bandura, 1997). Bandura (1997) pointed out that the most effective way of creating a strong sense of efficacy is through mastery experiences. Previous exercise behavior can influence the cognitive processing of experiences and shape the perception of difficulty in performing the exercise behavior.

Using a SCT framework, one can hypothesize that successful exercise performance raises self-efficacy toward exercise adherence, while failures lower self-efficacy. By observing others with a similar disease condition succeed in an exercise program, it may alleviate a patient's anxiety, encourage optimism, promote a sense of relief and raise her self-efficacy. Although verbal persuasion such as health professionals' exercise consultation, sharing information about an exercise program, and providing verbal encouragement for exercise has its limits, under the proper conditions it can be very effective.

Physiological and affective arousal can hinder or increase exercise performance, depending on the situation and the amount of arousal. For example, sensations of fatigue may be transformed into negative emotions and may be viewed with progress of cancer process. This can lower a patient's exercise self-efficacy and decrease motivation to exercise. Creating an enjoyable exercise environment or pleasant experience of past performances may make it easier for participants to recall when they felt better about themselves, and thereby increase their self-efficacy. Self-efficacy is behavior-specific. Therefore, self-efficacy for exercise is different from self-efficacy for smoking cession (Bandura, 1997).

Chapter II more thoroughly examines the current literature related to CRF, exercise, determinants of exercise, and Social Cognitive Theory. Knowing the factors that influence exercise behaviors for breast cancer survivors can assist health care providers in helping women increase their exercise involvement.

CHAPTER II

Review of Literature

Cancer-Related Fatigue

Introduction

Early reports addressing fatigue in humans generally referred to exhaustion of metabolic resources in muscle contraction or performance decrements in industrial setting (McFarland, 1971). The metabolic approach to fatigue continued with a focus on studying the performance of athletes and developing training methods that delayed the onset of muscle fatigue (Stegeman, 1981). Therefore, the development of work on fatigue in industry and in performance of athletes provides a portion of the historical context for work on Cancer Related Fatigue (CRF).

Fatigue is a multicausal, multidimensional, and complex concept which has been associated with many other terms, such as tiredness, exhaustion, weariness, malaise, weakness, incapacitation, and asthenia (Richardson, Ream, & Wilson-Barnett, 1998; Tiesinga, Dassen, & Halfens, 1996; Wu & McSweeney, 2001). There are also several other aspects of the term: affective and cognitive meanings such as "worn out" "overexerted," "overstressed," or " distracted." Differences in cultural values, meanings of words and concepts, and translation problems have influenced the meaning of fatigue (Glaus, 1998).

In several studies, patients who had been treated for breast cancer scored significantly higher than noncancer comparison subjects on standardized self-report measures of fatigue (Andrykowski, Curran, & Lightner, 1998; Broeckel, Jacobsen, Horton, Balducci, & Lyman, 1998; Hann, Jacobsen, & Martin, 1997; Servaes, Verhagen, & Bleijenberg, 2002). For example, Andrykowski, Curran and Lighner (1998) examined "off-treatment" fatigue at an initial assessment and at a 4-month follow-up assessment. A sample of 88 breast cancer (BC) patients with a mean of 53.8 years of age (SD= 9.3 years) with a mean of 24.9 months (SD=15.1 months; range,2-54 months) post completed BC treatment and an age-matched group of 88 women (mean age: 53.2± 8.7) with benign breast problems. Patients in BC group were primarily married (59%), Caucasian (91%), and some education beyond high school (54%), and reported significantly greater fatigue on Piper Fatigue Scale than women without a history of breast cancer (Andrykowski et al., 1998).

Cancer-Related Fatigue (CRF) differs from the fatigue that healthy people experience and it persists despite adequate and therapeutic rest and sleep. CRF may be related to the disease itself, treatment for the disease, and physical symptoms or conditions resulting from the disease or its treatment. Major characteristics include reduced energy that is disproportionate to activity, distress often associated with reduced physical performance or physical function, that is related to cancer or its treatment.

CRF has been recognized as having a major impact on functioning and quality of life for breast cancer patients (Vogelzang, 1997) and has high prevalence in the cancer population (Portenoy & Itri, 1999). It often disrupted the patients' ability and prevent patients from fulfilling their normal work and valuable role functioning. CRF has implications for an individual's economic, physical, psychological, and spiritual well-being (Irvine, Vincent, Graydon, Bubela, & Thompson, 1994; Nail & Winningham, 1995; Richardson et al., 1998; Spelten et al., 2003; Stone et al., 2003). CRF may persist for months or even years after completion of breast cancer treatment (Andrykowski et al., 1998; Bower et al., 2000; Broeckel et al., 1998). CRF may raise fears that the treatments did not work or that disease remains, and may serve as a reminder of the overall toll the cancer has taken.

Definition

One of the nursing theories to address CRF was Ryden's Conceptual Framework of Energy Expenditure (Ryden, 1977). With this theory, the human body is addressed as an open system that obtains energy from the environment to sustain life. Ryden (1977) pointed that the stress associated with adapting to cancer is a wasteful demand on limited energy resources that can deplete reserves and cause fatigue (Ryden, 1977). Piper and colleagues (1987) conceptualized fatigue from a nursing perspective as a subjective feeling of tiredness that is influenced by circadian rhythm and varies in unpleasantness, intensity, and duration. It is a multidimensional concept with several modes of expression: physical, cognitive, inactivity, and motivational (Piper, Lindsey, & Dodd, 1987). Fatigue has been defined as the end result of excessive energy consumption, depleted hormones or neurotransmitters, or diminished ability of muscle cells to contract from a physiological perspective (Berger, McCutcheon, Soust, Walker, & Wilkinson, 1991). It also is described as a subjective state of weariness related to reduced motivation, prolonged mental activity, or boredom from a psychological perspective (Lee, Hicks, & Nino-Murcia, 1991). Lee and colleagues (1994) defined fatigue as a perception of severity along a continuum from tired to exhausted that results from the balance between resources and demands placed on women by their internal (physiologic) and external (social) environments (Lee, Lentz, Taylor, Mitchell, & Woods, 1994). Winningham (1996) perceived fatigue as an energy deficit due to preexisting conditions and disease, related symptoms, treatment, environment influences, and inactivity.

Fatigue can be one of primary symptoms that lead to decreased activity. The secondary fatigue that arises from reduced physical activity is also critical. It leads to a cycle of decreased activity, fatigue, and reduced functional status (Winningham, 1996). Ream and Richardson (1996) described fatigue as "a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion creating an unrelenting overall condition which interferes with individuals' ability to function to their normal capacity" (Ream & Richardson, 1996, p.527). In addition, Aaronson and colleagues (1999) viewed fatigue as " The awareness of a decreased capacity for physical and/or mental activity due to an imbalance in the availability, utilization, and/or restoration of resources needed to perform activity" (p. 46).

Piper (1989) distinguished between acute and chronic fatigue states. She states everyone has experienced acute fatigue, which is perceived as normal and expected tiredness. It is intermittent and serves a protective function. Chronic fatigue associated with a disease or treatment of a disease persists for longer than a month and does not improve with rest (Piper, 1989). Acute fatigue is seldom regarded as a serious problem by health care workers because it is usually a temporary phenomenon. However, chronic fatigue is a frequent and distressing symptom for cancer patients. Therefore, cancer-related fatigue (CRF) is defined as chronic fatigue lasting for long periods and is associated with the cancer or cancer treatment and does not improve with rest (Dimeo, 2001). Gutstein (2001) described CRF as far different than fatigue expressed by healthy controls in physical/sensory, affective, and cognitive dimensions. CRF makes patients feel unusually tired, lacking motivation, anxious, sad, and unable to concentrate or think. However, the fatigue experienced by healthy people tends to reflect physical exhaustion and sleepiness without the unusual weakness or the same levels of affective responses (Gutstein, 2001).

Measurement Issues

In the past, certain disciplines and studies placed more attention and emphasis on investigations that used the more "objective" measures of fatigue in a healthy population. Less attention was given to the development and testing of self-report scales that could be used to measure the more "subjective" dimension of fatigue, particularly in a clinical population. Measurements used were either unidimensional fatigue intensity scales or multidimensional fatigue scales. The use of unidimensional scales with limited reliability and validity that assess the intensity or severity of fatigue is the most common way subjects have been asked to report their subjective experience. Similar to pain measurement, a variety of unidimensional severity scales have been used in research or clinical settings.

There are five salient characteristics of fatigue to assess when measuring fatigue- a) subjective quantification of fatigue; b) subjective distress of unpleasantness associated with fatigue; c) subjective assessment of the impact of fatigue on activities of daily living; d) key biological parameters associated with fatigue; and e) certain widely recognized correlates of fatigue (Aaronson et al., 1999).

Meek (2000) pointed out several factors that should be considered in measuring CRF. First, fatigue fluctuates over time and needs to be measured as a state rather than a stable construct. Instruments for measuring fatigue must be stable and sensitive enough to use repeatedly to detect actual changing levels of fatigue. Second, because some concepts such as depression and muscle weakness have close relationship with CRF, divergent validity is very important to consider for fatigue measures. Third, for both clinical and research use, the CRF measure needs to be brief and simple enough to not burden patients (Meek et al., 2000).

The Concept of Exercise

Exercise, a sub-category of physical activity, is "a planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness" (American College of Sports Medicine, 2000), p.4). Physical activity tends to be narrowly defined as exercise in many studies. The

American College of Sports Medicine (ACSM) describes "physical activity "as bodily movement that is produced by the contraction of skeletal muscle and that substantially increase energy expenditure. Exercise is a purposeful physical activity of a type, intensity, and duration needed to reach a moderate level of exertion and improve health or well-being. ACSM recommends "an intensity of exercise corresponding to between 55 and 65% to 90 % of maximum heart rate (HRmax)"(p.145) and "the average rating of perceived exertion range associated with physiologic adaptation to exercise is 12 to 16 ("somewhat hard" to " hard") on the category Borg scale" (p.149). The duration of exercise recommended by the ACSM reflects that interaction-20 to 60 minutes of continuous or intermittent (minimum of 10-minute bouts) aerobic activity accumulated throughout the day. The optimal exercise frequency appears to be achieved with 3 to 5 workouts per week (American College of Sports Medicine, 2000).

Different perceptions of feminine identity many affect women's attitude toward exercise. In ancient patriarchal societies, women had a moral duty to preserve their vital energy for child-bearing and wife-and –mother roles. Furthermore, women were discouraged from participating in exercise because exercise may make women develop muscles and look strong (Balsamo, 1996) which strongly violated the traditional view of feminine identity. In addition, exercise has been related to women's ideal body. The concepts of beauty are not universal and ideals of beauty change through time and cultures. In the past, people defined large, plump bodies as being attractive; the same perception of beauty during Tang Dynasty in China. However, the traditional association of fatness with prosperity and good health in the upper classes disappeared in the twentieth century (White, 1991). Being overweight is now regarded as unhealthy, and a slim body has become a positive image for modern women. People have used diverse sources such as fashion models, playboy magazines, and beauty queen contestants to reveal trends of decreasing weight and slimmer bodies.

Moreover, it has been found that Chinese women share an ideal of slimness with Western women (Johnson, 2000). Exercise began to be used by women in U.S. and Taiwan to meet their new beauty ideal-slender bodies. The desire for a slim body is viewed as control over moving forward with emotional development and womanhood (Chemin, 1981) and is associated with self-control, elegance, social attractiveness, and youth (Furnham & Baguma, 1994). For young urban women in Taiwan who enjoy education, career development, and mate choice, slimness is symbolic of attractiveness and competence in both social and work-related domains. In contrast, rural Taiwanese women's lives are still under substantial patriarchal influence, whereby bodily fullness may symbolize family fertility and wealth, and affect rural women's marriage ability and ultimate well-being.

The principle that human harmony with the world is the key to prevention and to long life has guided Chinese culture through the present day (Shampo & Kyle, 1989). Practitioners in Chinese culture equated health with balance, both internal balance of bodily functions and external balance with the surrounding environment (Breslow, 1989). According to Traditional Chinese Medicine, most disease and discomfort is caused by an imbalance of qi (the Yin and the Yang) inside one's body (Beinfield, 1991). Both proper diet and exercise are known to be essential principles of daily living to keep the balance of Yin and Yang for Chinese people.

Exercise, like many other health behaviors, is often episodic. Many people begin exercising and then stop. Research indicates that approximately 50% of individuals who start a formal physical activity program will drop out in 6 months or less (Dishman, 1982; Hooper & Veneziano, 1995; Marcus, Rakowski, & Rossi, 1992; Marshall & Biddle, 2001). However, in studies of cancer patients actively receiving cancer treatment, adherence rates are much higher. Schwartz (2004) reviewed several studies and concluded that adherence rates for exercise intervention programs ranged from 60% to 89% over periods of eight weeks to 12 months; 33% to 92% of eligible patients agreed to participate and attrition rates ranged from 6% to 25% (Schwartz, 2004). The cyclical nature of exercise has led to increasing interest in examining exercise determinants during different states of this cycle. Although emphasis is place on the need to distinguish adoption, maintenance, and resumption of exercise, virtually few studies have discriminated between adoption and maintenance (Annesi, 2002b; DuCharme & Brawley, 1995; Sallis, Hovell, & Hofstetter, 1992). The term adherence has been defined as " the level of participation achieved in a behavioral regimen once the individual has agreed to undertake it" (King, 1994, p. 186).

Cancer-Related Fatigue and Exercise

Prevalence of Cancer-Related Fatigue

In general, research suggests that many cancer patients, including women with breast cancer, report fatigue, decreased stamina, or loss of energy long after completion of chemotherapy or radiotherapy. Previous studies have suggested 31% -56% of breast cancer survivors experience fatigue after completing treatment (Bower et al., 2000; Okuyama et al., 2000). Beisecker and colleagues (1997) interviewed 21 node-negative breast cancer patients one month after completing adjuvant chemotherapy. Nineteen of the 21 women were interviewed 6 months later and asked about side effects they had experienced. Most subjects were white (85%), middle aged (mean age: 48.65), married women (71%) with children (86%), who were employed (90%) and had at least a high school education (70%). They found that fatigue was the second leading side effect reported by subjects for both interviews and one third of women were still experiencing decreased energy 6 months after completing treatment (Beisecker et al., 1997). This study used a prospective longitudinal design but sample size was small and subjects were self-selected.

Okuyama and colleagues (2000) investigated a group of 135 (97.1%) randomly selected ambulatory breast cancer patients (mean age 55.1± 10.3, range 28-86) who had undergone successful surgical treatment. The sample was largely married, highly educated, living with others, and stage I (23.1%) and II (56.7%) breast cancer survivors. The mean number of days since the last chemo- and radiotherapy was 537± 458 days and 516± 364 days, respectively. Fatigue was assessed using the 15-item Cancer Fatigue Scale (CFS) consisting of three subscales-physical, affective, and cognitive. Seventy-five of subjects (56%) experienced some fatigue and their average total CFS mean score was 16.4±7.9 (score range: 1-42). Fatigue in this study was determined by current physical and psychological distress such as dyspnea, insufficient sleep and depression rather prior cancer treatment (Okuyama et al., 2000).

Servaes and colleague (2002) contacted 263 women with breast cancer and 59% (n= 150) who had finished curative treatment. The mean since the completion of treatment was 29 months (SD=17, range: 6-70months). Fatigue severity was measured by the fatigue severity subscale (CIS-fatigue) and severe fatigue was defined as CIS-fatigue scores ≧ 35. They reported 38% of the sample as severely fatigued, compared with 11% in a matched sample of women without a history of cancer ($p<0.001$)(Servaes et al., 2002).

Mechanisms of Fatigue in Cancer

Patients with breast cancer experience many potential causes of fatigue. Currently, it is not clear which mechanisms may be responsible for CRF. Physical fatigue results from alterations in the muscular energetic systems caused by cancer treatment. Brook, Fahey, White and Baldwin (2000) stated that the muscle cells obtain energy for work through three pathways; the ATP-CP system (nonaerobic pathway), fast-glycolytic (anaerobic pathway), and slow-glycolytic (aerobic pathway). The first two pathways, which require little or no oxygen to generate energy, provide a short-term supply of energy. The third pathway, which can only be carried out in the presence of oxygen, is the major energy source for physical activity. Therefore, adequate oxygen delivery to cells is the critical factor in energy production (Brooks, 2000). Several functional and anatomic changes due to cancer treatment can affect the oxygen supply to the cells. Treatments such as chemotherapy and radiotherapy frequently damage bone marrow, impair erythrocyte production, and change heart function resulting in decreasing blood oxygen transport capacity and subsequent oxygen supply to the cells. Loss or low pulmonary function can result from cancer or its treatment. These changes affect pulmonary diffusion and perfusion and therefore impair blood oxygenation (McCorkle, 1996). Tumor growth, infection, fever, or surgery can abnormally increase metabolism and decrease availability of metabolic substrate resulting in cancer patients are unable to carry out normal daily activities. In addition, malnutrition, dehydration and inadequate sleep/ rest are likely to contribute to CRF as well as pathopsychologic factors such as anxiety and depression (Portenoy & Itri, 1999). In addition, treatment with corticosteroids may contribute to significant loss of muscle mass (Braith, Welsch, Mills, Keller, & Pollock, 1998; Horber et al., 1987)

Morrow and colleagues (2002) proposed four plausible hypotheses for the development of CRF: the anemia hypothesis, the ATP hypothesis, the vagal afferent hypothesis, and the hypothalamic-pituitary axis, cytokines and 5HT (serotonin dysregulation) hypothesis. Anemia may contribute to fatigue in some cancer patients but the mechanism by which anemia could cause symptoms has not yet been identified. Patients in treatment often report alterations in appetite resulting in decreased food intake and slow ATP generation. Compromised blood supply to tumors results in low oxygen area of the tumors, associated with deprivation of nutrients and energy and severe tissue acidosis. Chemotherapy for cancer patients could relate to alterations in energy metabolism. Tissue damage from radiation therapy release of cytokines, including IL-1β and tumor necrosis factor alpha (TNF-α) by mononuclear cells and tumors cells. IL-1β can stimulate vagal afferents to generate many features of the "sickness syndrome" such as fatigue. TNF could alter central serotonin levels by increasing neuronal release of serotonin (5-HT) and by up-regulating the 5-HT transporter which is a feedback loop to keep cytokine balance. Serotonin is a contributor to fatigue, sleep problems and depression. Cancer and aggressive treatment make the feedback mechanism dysfunctional, which increases serotonin and may produce fatigue (Morrow, Andrews, Hickok, Roscoe, & Matteson, 2002).

Deconditioning As A Result of Inactivity

Most patients and many health care providers in Taiwan perceive Cancer-Related Fatigue (CRF) as a normal phenomenon of the process of disease and treatments. Patients may not report CFR and health professionals usually focus on other symptoms. In the U.S, Vogelzang and his colleagues (1997) reported that only about 50% of cancer patients discuss CRF with their physician and in only 25% of cases intervention is provided (Vogelzang, 1997). Fifty-nine percent of breast cancer patients (n=71) reported that their physicians did not mention exercise to them as part of their rehabilitation (Young-McCaughan &

Sexton, 1991).

When patients do not have guidance from healthcare professionals, they tend to employ common-sense approaches. They adopt measures that generally alleviate the normal tiredness that healthy people experience when lacking approaches (including sleeping, resting, and napping) but frequently fail to alleviate the fatigue associated with cancer. Even though health care professionals provide some advice for fatigue, the common recommendation is rest (Stone et al., 2003). However, this advice may place a patient in a sick role and even precipitate conditions associated with inactivity and hypokinetic diseases. Inappropriate or prolonged use of rest will induce further muscle wasting and loss of cardio respiratory fitness. It may increase CRF and decrease an individual's quality of life. Inactivity and bed rest lead to physiological deterioration. Impairments include diminished capacity of the heart, reduced plasma and blood volumes, impaired blood vessel autoregulation, decreased maximal O2 consumption, muscle atrophy, orthostatic intolerance, and bone demineralization (Brooks, 2000). Other effects of decreased activity include urinary tract infections, thrombophlebitis, pulmonary embolism, pneumonia, constipation, insulin resistance and glucose intolerance (Biolo et al., 2005; Gathof, Picker, & Rojo, 2004; Langmore, Skarupski, Park, & Fries, 2002; Simren, 2002). It has been estimated that one-third or more of the decline in functional capacity experienced by cancer patients results from hypokinetic conditions developing as a consequence of prolonged physical inactivity (Hinterbuchner, 1978; Rosenbaum, 1982). In a study with 6 healthy subjects, short-term bed rest (less than 7 days) led to declines in muscle volume (2% to 5%), power of the extensor and flexor muscles of legs (23% to 25%) and muscular endurance in the upper and lower extremities (17%) (Shangraw, Stuart, Prince, Peters, & Wolfe, 1988).

Benefits of Exercise

The benefit of exercise are well-documented in the general population. Exercise is one of the few interventions suggested to prevent or decrease CRF. Winningham, MacVicar, and Johnson (1985) initially identified the benefits of exercise for fatigued patients with cancer. They discovered that breast cancer patients who participated in a cycling rehabilitation program would increase exercise tolerance and enhance functional capacity (Winningham, 1985). Exercise also produces adaptive changes such as improvement in cardiac performance, maintenance in lean body mass, gains in muscle mass and plasma volume, improved lung ventilation and perfusion, prevention or decreased incidence of osteoporosis, and emotional benefits (Brooks, 2000).

In order to document the effect of exercise on CRF for cancer patients, computer searches were performed using CD-ROM databases Cancer lit, CINAHL and Medline from January 1985 to December 2001. Key words that related to cancer fatigue (e.g., cancer fatigue, physical performance, and functional capacity) and exercise (e.g., exercise, physical activity) were combined and searched. "Physical performance" and "functional capacity" were used as key words because most studies used those terms as testing indicators of level of fatigue. Eight research studies that have included an exercise component as an intervention for cancer patients were summarized. Participants in those studies were largely drawn from samples of breast cancer patients who ranged in age from 32 to 50 years old (mean age was 43 years). The majority of participants were white, married, and well educated. Sample sizes ranged from 14 to 70 patients. The attrition rate ranged from 7% to 30%, with an average of 16%. The major reasons for attrition were disease progression and complications. Four of 8 studies used a quasi-experimental research design. Exercise program length ranged from six weeks to twenty-four weeks. The types of exercise being evaluated were walking on a treadmill or at home for 5 studies and biking for 3 other studies. No researcher provided the rationale for the frequency, duration, and intensity of exercise. It is critical to identify the optimal level of activity that can be performed at lowest risk (Dimeo et al., 1996; Dimeo, Fetscher, Lange, Mertelsmann, & Keul, 1997; Dimeo, 1999; Dimeo et al., 1997; MacVicar, Winningham, & Nickel, 1989; Mock et al., 1997; Mock et al., 2001; Schwartz, Mori, Gao, Nail, & King, 2001).

Seven of the eight studies measured physical performance or functional capacity to estimate the objective level of fatigue. Only three studies used self-report fatigue instruments (Symptom Assessment Scales, Piper Fatigue Scale, Profile of Mood States, Fatigue Visual Analog Scales) to measure subjective fatigue.

Each effect size and variance of effect size was calculated for the previously mentioned eight studies by the DSTAT program (Johnson, 1989). In an effort to ensure that these values were not distorted by the results from small-sample studies, they were weighted by sample size and quality scores of studies to get average effect sizes of physical performance and functional capacity (objective fatigue). Quality of the study was measured by ten criteria - author(s) expertise, controlled for threats to validity, representative sample, instruments(s) validity, appropriate statistics, design, sample size, data collection, instrument(s) reliability, presentation of data (Brown, 1991). Criteria were scored on 4-point Likert scale anchored by 0 (absent) and 3 (high) and total scores range from 0-30. The higher the total score, the higher quality of the study. Average effect sizes of subjective fatigue (instrument) were weighted by sample size due to the inclusion of only three studies. Effect sizes (in standard deviation unit) for the subjective fatigue were 0.83 and 0.83 for physical performance (functional capacity). Therefore, the average cancer patient in an exercise group had a significantly less fatigue than 80% of cancer patients in control groups and significant improvement in physical performance compared to 80% of cancer patients in control groups. The results of those studies provided evidence that there is a positive effect of exercise on fatigue and exercise improves physical performance in breast cancer patients.

Although these studies identify the potential value of exercise for management of CRF, there were several limitations. First, those studies were conducted primarily with samples of patients with breast cancer with small sample sizes that may not be representative of the entire breast cancer population. Second, although all eight studies listed reasons for people who dropped out, none of them compare differences between the attrition group and the participant group which could have a significant threat to validity, especially for some studies with higher attrition rates (15%~30%). Third, reducing subjective fatigue for women with breast cancer from exercise may not be generalized from only three studies. More studies are needed to corroborate these findings.

Preliminary studies in women with breast cancer show promising results. However, researchers should explore the merits of remaining active by performing commonplace activities such as walking and household chores or of tailored exercising programs that take into account previous exercise levels. Further research is needed to determine if the results can be replicated and to examine the extent to which an exercise intervention is feasible and acceptable to patients with breast cancer with a variety of treatment regimens. Although several studies in U.S. examining the benefits of cardiovascular training, resistance and flexibility training exercise program on breast cancer survivors, Galvao and Newton (2005) reviewed exercise interventions in cancer patients and found that most of these studies had limitations because they were not randomized controlled trials, used small sample size, and/ or insufficient scientific methodological criteria (Galvao & Newton, 2005).

Many cancer survivors will be at a particularly high risk of developing a recurrence of their disease and/or a secondary malignancy. It has been proposed that exercise may positively influence immune system important in anticancer defense (Fairey, Courneya, Field, & Mackey, 2002). The immunologic and hormonal changes induced during exercise may serve to moderate disease progression and prevent cancer recurrence (Courneya & Friedenreich, 1997; Fairey et al., 2002). Fairey and colleagues (2002) provided a comprehensive review of six empirical studies published between 1994 and 2000 which examined physical exercise and immune system function in cancer survivors. The sample sizes for studies ranged from 6 to 70 survivors and three of six studies examined breast cancer survivors. Three studies were randomized controlled trials with normal/standard care controls. The primary exercise mode in three out of six studies was cycle ergometer and the exercise was supervised for the entire duration in four studies. Four out of six studies reported statistically improvements in immune system function as a result of exercise, including improvements in NK cell cytolytic activity, monocyte function, proportion of circulating granulocyte function, proportion of circulating, granulocytes, and duration of neutropenia.

Although the literature suggests that exercise may have a positive influence on immune system important in cancer defense, several limitations need to be considered-1) convenience samples; 2) small sample size; 3) heterogeneous subjects; 4) exercise intervention period is relatively short; 5) samples of peripheral blood may not be representative of the condition of the whole body because a large percentage of all leukocytes are normally found outside of the circulating peripheral blood; 6) no information related to medications, sleeping patterns, diet and nutritional status which might influence immune system was provided; and 7) time points for collecting blood were not clear (Fairey et al., 2002).

Additionally, exercise has been empirically demonstrated to result in greater self-esteem (Courneya et al., 2003; Mustian et al., 2004; Nelson, 1991; Pinto &

Trunzo, 2004) and body image (Mock et al., 1994; Pinto, Clark, Maruyama, & Feder, 2003), increase muscle strength (Durak, 1999), improve sexual activity (Fobair et al., 1986; Pinto & Trunzo, 2004), increase interpersonal support (Smith, 1996), control weight gain (Kolden et al., 2002; Schwartz, 1999, 2000; Segar et al., 1998), decrease feelings of anxiety and depression (Christopher & Morrow, 2004; Mock et al., 1994; Pinto & Trunzo, 2004; Segar et al., 1998), and improve overall quality of life in cancer patients (Blanchard et al., 2003; Christopher & Morrow, 2004; Kolden et al., 2002; McKenzie & Kalda, 2003; Mock et al., 2001; Mustian et al., 2004). Exercise also improved cerebral functioning and enhanced memory, concentration, and attention span (Smith, 1996).

Segar et al. (1998) conducted a randomized clinical trial to evaluate the effect of ten weeks of aerobic exercise on depressive, anxiety, and self-esteem in 24 sedentary breast cancer survivors. Exercise adherence was calculated as minutes exercised per session, times the number of sessions, divided by total possible exercise minutes. Thus, 100% compliance would be 30 minutes x 40 sessions (1200 minutes) and $\geqq$89% compliance was chosen by the investigators to be an adequate adherence rate. They found that women who adhered to the exercise program had significantly less depression and anxiety over time compared to the control group. It is clear that exercise plays a role in helping the cancer patient improve emotional distress and quality of life (Segar et al., 1998).

Kolden and colleagues (2002) conducted a study to determine the feasibility, safety, and benefits of group exercise training for women with breast cancer. Participants met three days a week for a period of 16 weeks and each one-hour session included warm-up (10-15 min), aerobic training (duration > 20min), and cool down (20min) phases. The activities included walking, cycling, step and dance movements, and other aerobic activities. Exercise intensity and duration was prescribed on an individual basis using results from baseline fitness assessment (initial intensity: 40-60% of estimated maximal aerobic capacity then 70% by the end of the 16-week period). Forty women (attrition rate: 20%) completed the 16-week group exercise training and participated in 88% of the sessions (SD=4.5%). Results demonstrated that group exercise training was feasible, safe, and well-tolerated. Fitness/ vigor (aerobic capacity, strength, flexibility) and quality of life (increased positive affect, decreased distress, enhanced well-being, and improved functioning) were significantly improved. However, the participants were highly self-selected and might not be representative of all women with breast cancer. Moreover, it was a one group pre- and post design with no control group to compare. It could not be determined. We were not sure with improvements which came from exercise intervention or simply changes over time. Even though the researchers used valid and reliable subjective and objective measurements for variables, sensitivity and specificity for objective measurements and validity of subjective measurements were not clearly described (Kolden et al., 2002).

Courneya and colleagues (2003) conducted a randomized controlled trial to examine the effects of exercise training on cardiopulmonary function and quality of life (QOL) among fifty-two postmenopausal breast cancer survivors. Participants were randomly assigned to an exercise (n=25) or control (n=28) group. The exercise group trained three times per week for 15 weeks on recumbent or upright cycle ergometers. Peak oxygen consumption, and overall QOL were primary outcomes. Peak oxygen consumption increased by 0.24 L/min in exercise group, whereas it decreased by 0.05 L/min in control group (mean difference, 0.29 L/min, $p < .001$). QOL increased by 9.1 points in exercise group compared with 0.3 points in control group (mean difference, 8.8 points, $p = .001$). Researchers also found evidence for exercise beneficial effects on changes in peak power output, submaximal cardiopulmonary function, happiness, self-esteem, fatigue, and several subcomponents of overall QOL. Strengths include the randomized clinical trial design, validated measures of peak oxygen consumption, and a high exercise adherence rate (94.8%). Limitations include a very low recruitment rate (14%), a small sample size, and a short exercise intervention with no long-term follow-up (Courneya et al., 2003).

Prevalence of Exercise in Non-cancer Population

The prevalence of exercise in the non-cancer population is low in North America. Twenty-two percent of American adults report participate in regular physical activity (Sherwood & Jeffery, 2000). Forty percent of American women engage in some form of regular physical activity (Caspersen & Merritt, 1995). Almost one quarter of all American adults are completely sedentary (Eyler et al., 1999) when regular exercise was defined as exercise at moderate level at least 20 min each time, at least three times per week. In Taiwan, Kao and Huang (2000) stated that approximately one-third or less of adult Taiwanese report engaging in regular physical activity (Kao & Huang, 2000). Another two studies found that 50% of Taiwanese adults age 40 or older and more than 75% of Taiwanese young people under age 20 are not physically active (Huang, 1991; Liu, 1996). The benefits of exercise can only be experienced by regularly participating (Courneya & Friedenreich, 1999) and understanding the determinants of exercise is the critical step toward developing effective interventions for breast cancer survivors.

Prevalence of Exercise in Breast Cancer Survivors

Previous researchers reported that 15% to 44% of breast cancer survivors engaged in some form of physical activity in the 5 years after their cancer diagnosis (Blanchard, Courneya, Rodgers, & Murnaghan, 2002; McBride, Clipp, Peterson, Lipkus, & Demark-Wahnefried, 2000; Pinto, Maruyama, Engebretson, & Thebarge, 1998; Young-McCaughan & Sexton, 1991). Three studies reported 20% to 32% of breast cancer survivors met the ACSM recommended level of physical activity- to accumulate 30 or more minutes of moderately intense physical activity on 5 or more d/wk or vigorously intense physical activity 3 times/wk for at least 20 min/session (Blanchard et al., 2003; Irwin et al., 2004; Pinto et al., 1998). Irwin et al. (2004) examined 1223 breast cancer survivors through a population-based, multi-center, multi-ethnic prospective cohort study design (response rate was 65.9 %). The type, duration, and frequency of activities performed in the past year were assessed. Thirty-two percent of survivors met the ACSM recommendations. However, these results can only be generalized to women with stages 0-IIIA breast cancer living in Los Angeles, Western Washington, and New Mexico (Irwin et al., 2004).

The Determinants of Exercise

Personal Characteristics

Personal characteristics include sociodemographic factors (i.e. education, age, gender, occupation, marital, personality, past exercise history), health status, self-efficacy, and outcome expectancy that may influence exercise behavior. Each of these characteristics will be described in turn.

Sociodemographic factors. The demographic correlates of sports/exercise and active living have been well documented by many studies (Eyler et al., 2002; King et al., 1992; Sallis & Hovell, 1990).

Education: Education was positively related to exercise in various studies on women of ages ranging from 20-65 (N=158-2912) (Brownson et al., 2000; Hawkes & Holm, 1993; Jones et al., 1998; Sallis et al., 1992; Stahl et al., 2001; Sternfeld, Ainsworth, & Quesenberry, 1999; Yeager, 1993). However, several studies did not show a significant relationship (Chen et al., 1998; Felton, Parsons, & Bartoces, 1997; King, 2000; Lookinland, 1996; Ransdell & Wells, 1998).

Age: Older age was associated with less exercise activity in some studies (Conn, 1998; Courneya & Friedenreich, 1999; Jones et al., 1998; Laffrey, 2000; Yeager, 1993). For example, Courneya and Friedenreich (1999) used a mail survey to examine the utility of the Theory of Planned Behavior in understanding cancer patients' exercise behaviors during treatment. A total of 164 women who had been diagnosed with breast cancer within the previous 2 years participated in the study. Exercise behavior was assessed by the leisure score index (LSI) of the Godin Leisure Time Exercise Questionnaire which contains three questions covering the frequency of mild, moderate, and strenuous exercise done during free time for at least 15 minutes duration in a typical week. The mean age of the sample was 53.0 years (SD=9.4), 70% were married, 34% completed university, and 38% worked full time. The mean number of months since diagnosis was 17.5 (SD=4.6); 87% of the sample were at stage I or II of the disease and 88% received radiation therapy alone or combined with other theories. The result indicated that age had a significant negative correlation with strenuous exercise ($r=-.19$, $p<0.01$), indicating that older women reported less strenuous exercise. However, this study used a retrospective design which might have introduced the possible bias in memory recall in exercise levels (Courneya & Friedenreich, 1999). Other studies reported no relationship between age and exercise (King, 2000; Ransdell & Wells, 1998; Resnick, Palmer, Jenkins, & Spellbring, 2000; Sallis et al., 1992; Stahl et al., 2001; Young-McCaughan & Sexton, 1991).

Gender: Several studies have found that women are less active than men if sporting or vigorous activities are a prominent component (Sallis et al., 1986; Treiber et al., 1991; Wallace, Buckworth, Kirby, & Sherman, 2000). Women are more likely be inactive than men. Gender differences are consistent across age groups and for different ethnic groups. Results differ, though, based on the intensity of physical activity (Wallace et al., 2000). Women are more likely to describe that release of tension and social factors are major benefits of exercise. However, men tend to point out that fitness and health are major concerns for exercise.

Factors influencing adoption and maintenance of exercise behavior are different for men and women. Sallis and his colleagues (1992) used a mail survey to examine predictors of adoption and maintenance of vigorous physical activity over 24-month in a sample of 1719 randomly selected women and men. The study sample had a mean age 50.3 (SD=16.41) and was well-educated (mean=15±2.8), married (61%), male (58.1%) and Caucasian (88%). Vigorous physical activity was defined as physical exercise for at least 20 minutes without stopping and trichotomized as sedentary (0 sessions / per week), intermediate (1-2 sessions / per week), and active (>3 sessions / per week). Predictors of change in vigorous physical activity were different for men and women and different for adoption and maintenance. Adoption by sedentary men was predicted by self-efficacy, age (inverse), and neighborhood environment (inverse). Adoption by sedentary women was predicted by education, self-efficacy, and friend and family support for exercise. Maintenance was predicted by self-efficacy and age (inverse) for initially active men and by education for initially active women. However, generalization should be made with caution. A response rate of 43.4% from 4729 residents was obtained, comprising 2053 adults in the original sample. Participants were very self-selected. A response rate of 85.5% of the original sample completed follow-up surveys. Nonrespondents (n=272) were compared with respondents of the follow-up survey (n=1719) on demographic, and potential determinant variables at baseline and there were significant differences on ethnicity, education, and income (not clear). At baseline the dropouts had higher levels of exercise knowledge ($p < .001$), had lower levels of family support for exercise ($p < .05$), were younger ($p < .05$), had less education ($p < .001$), were more likely to be Latino ($p < .05$), and had lower incomes ($p < .001$). Thus, the bias introduced by attrition tended to increase the overrepresentation of non-Hispanic white, well-educated, high-income population (Sallis et al., 1992).

The relationship between occupation and physical activity level remains unclear. Personal, program-based, and environmental barriers to physical activity were explored among a U.S. population-derived sample of 2,912 women 40 years of age and older (King, 2000). They found that there was no relationship between employment and physical activity. Sternfeld, Ainsworth and Quesenberry (1999) conducted a mail survey using a random sample of 2,636 ethnically diverse women and reported that being employed was positively associated with sport/exercise in black women (Sternfeld et al., 1999). Another two studies found white women employed outside the home were more likely to exercise (Bild et al., 1993).

Marital status: marital status has had an inconsistent relationship with physical activity among women. Several studies found no relationship (King, 2000; Ransdell & Wells, 1998). Some studies reported that married women were more active in exercise than were unmarried women (Sternfeld, Cauley, Harlow, Liu, & Lee, 2000; Wilbur, Miller, Montgomery, & Chandler, 1998). In contrast, Sternfeld, Ainsworth and Quesenberry (1999) used a one-time mail survey in a random sample of 2636 ethnically diverse women. The physical activity was assessed by the Kaiser Physical Activity Survey (KPAS) which was adapted from the Baecke questionnaire (Baecke, Burema, & Fritjers, 1982). KPAS uses categorical responses regarding frequency of domain-specific activities to create four activity indices (sports/exercise, active living, occupational, household/caregiving). Reliability and validity of KPAS has been demonstrated in another study. The overall response rate was 59.3% and the major reason for no response was wrong addresses. The sample was 65.9% white, 76.2% completed high school, 73% employed, and 68.4% married. They observed that being married was negatively associated with sports/exercise but positively related to household /caregiving physical activity. However, a significant proportion of the respondents (25%) were not able to complete the KPAS, which might increase report bias.

Past exercise history. Prior history of exercise may influence future exercise behavior by promoting and shaping self-efficacy for exercise and by developing exercise skills. Past participation in exercise is positively correlated with present participation (Conn, 1998; Courneya et al., 2004; DuCharme & Brawley, 1995; McAuley, 1992). DuCharme and Brawly (1995) examined the influence of various aspect of self-efficacy on the attendance (exercise frequency) during a 16-week exercise program in a sample of 63 healthy novice female exercisers (mean age 26± 8.7). The average weekly number of exercise sessions attended was calculated for each 8-week period (time1 involved weeks 1 through 8, while time 2 involved weeks 9 through 16). They found barrier efficacy and scheduling efficacy did not significantly add unique contribution to exercise attendance but behavioral intention alone predicted attendance during week 1-8 (R^2 change= 12%, $p=0.05$). Scheduling efficacy explained a significant 16% of variance in attendance and the addition of previous exercise behavior (past attendance) significantly contributed more to the prediction of attendance during weeks 9-16 (R^2 change= .24, $p< .001$). However, self-efficacy was operationalized as both perceptions to overcome potential exercise barriers and perceptions of ability to schedule regular exercise sessions. These two formats of self-efficacy used in this study might underrepresent the efficacy concept in this exercise domain.

Cancer-related fatigue. The relationship between fatigue and physical activity has rarely been investigated in the literature, and only during active treatment for cancer (Berger, 1998; Dimeo et al., 1997). Results suggest a negative relationship between physical activity and fatigue. Results from Servaes et al. (2002) also suggest that lower physical activity is related to more severe fatigue after treatment for cancer.

The associations between fatigue and demographic factors among breast cancer survivors remain controversial. Income and education evidenced a small to moderate negative relationship with Piper fatigue measure (education- $r=-.21$;

income-$r = -.28$, both $p < .05$). However, retrospective measures of fatigue cannot determine the diurnal fluctuations in fatigue, and recalled fatigue experiences over the past week requires some " averaging" of an individual's fatigue, resulting in a potential bias. Mast (1998) also examined correlates of fatigue in a sample of 109 women (50%) who completed treatment an average of 35 months (SD=17) at stage I to III breast cancer survivors. They found that fatigue had a significant correlation with education ($r = -.38$, $p = 0.001$) but did not correlate with age, time since treatment, disease stage, or Tamoxifen treatment (Mast, 1998).

However, Broeckel et al. (1998) examined the characteristics and correlates of fatigue among a group of 61 breast cancer who had completed chemotherapy an average of 471 days previously (SD:211.74; range:108 to 875 days) and 59 women with no history of cancer. Fatigue severity was measured by the Fatigue /Inertia subscale from the Profile of Mood States, the Fatigue Symptom Inventory, the Multidimensional Fatigue Symptom Inventory, and the Fatigue Catastrophizing Scale. This study used valid and reliable standardized measures of fatigue as well as the inclusion of an age-matched comparison group of women with no history of cancer. None of the demographic variables assessed (i.e., age, martial status, ethnicity, education, or employment status) were significantly related to fatigue severity but women who experienced more menopausal symptoms after completion of adjuvant chemotherapy reported more severe fatigue (Broeckel et al., 1998). A total of 1957 breast cancer survivors were recruited from two large metropolitan cities to complete survey regarding QOL, sexuality, and intimacy. Approximately one third of survivors reported more severe fatigue (35%), which was significantly associated with younger age, lower yearly income, and being single. Ethnicity, education, and employment status were not associated with fatigue. Although types of treatment did not emerge as a significant predictor of fatigue in logistic regression analysis in this study, woman in fatigued group were more likely to have been treated with a combination of chemotherapy and radiation therapy or with chemotherapy alone than those in the non-fatigued group. In contrast, women in the non-fatigued group were more likely to have been treated with radiation alone or with surgery alone (Bower et al., 2000).

Most studies do not support a relationship between fatigue and type of treatment, time since diagnosis, or treatment and disease stage at diagnosis (Broeckel et al., 1998; Okuyama et al., 2000; Servaes et al., 2002). Okuyama and colleagues (2000) examined a group of 134 randomly selected ambulatory breast cancer patients and found that factors concerned with the cancer and treatment (such as disease stage, lymph node metastasis, number of days since operation, past intravenous chemotherapy, radiotherapy, or current use of Tamoxifen citrate) were not correlated with fatigue as measured with the 15-item Cancer Fatigue Scale (CFS) composed of 3 subscales (physical, affective, and cognitive subscales)(Okuyama et al., 2000). The reliability and validity of the CFS have been established by testing in 307 cancer patients in Japan (mean age 58 years; 64%: female; 50%: breast cancer and 32%: lung cancer patients) (Okuyama et al., 2000). Construct validity which confirmed by factor analysis and convergent validity which confirmed by a correlation between CFS and a visual analogue scale of fatigue (r= .67) were good. Cronbach alpha coefficient was good (α for 15 item = .88) and test-retest reliability was modest (r= .67) (Okuyama et al., 2000).

However, some studies found there was a relationship between fatigue and the types of treatment. For example, Mast (1998) investigated correlates of fatigue in a sample of 109 women with stage I to III breast cancer survivors (mean age: 60.0± 12.9 year old; range= 20-90 years). The sample was largely Caucasian (97%) and well-educated (high school: 45.9%; graduate: 16.5%). CRF was measured by the fatigue item of Holmes's revision of McCorkle and Young's Symptom Distress Scale. Fatigue scores were low to moderate and highly variable (Mean=30.22±20.59 on the 0-100 scale). They reported that fatigue in breast cancer survivors was significantly related to treatment with chemotherapy (F=4.78, p= . 031- four groups-C/T with R/T or no R/T vs. surgery with CT and /or RT or no with CT and /or RT.), irrespective of length of time since treatment, age, disease stage, or Tamoxifen use (Mast, 1998). However, a single item measure does not capture the multiple dimensions of the fatigue experience. Nevertheless, these results have to be interpreted with caution because those studies had a cross-sectional design and causality between fatigue and the factors investigated can not be posed.

Although fatigue is often noted as a physical symptom, health care professionals might pay more attention to the psychological state of a cancer patient who complains of fatigue. Previous studies demonstrated physical and psychological distress correlated significantly with fatigue (Broeckel et al., 1998; Okuyama et al., 2000; Servaes et al., 2002). Broeckel and colleagues (1998) assessed 61 women (mean age: 51.58 ± 11.10) with breast cancer who had completed chemotherapy an average of 471 days previously and 59 women (mean age: 51.47 ± 11.25) with no history of cancer. Fatigue was measured by the Profile of Mood States (POMS), the Fatigue Symptom Inventory (FSI), and the Multidimensional Fatigue Symptom Inventory (MFSI). Results indicated that the former chemotherapy patients reported more severe fatigue as measured by the POMS-F ($p < .01$) and the FSI ($p < .05$) than the noncancer comparison subjects. The former chemotherapy patients scored significantly higher on the General ($p < .05$), Physical ($p < .01$), and Mental ($p < .01$) fatigue subscale in MFSI after completion of adjuvant treatment. Servaes and colleague (2002) investigated 263 women who had finished curative treatment for breast cancer a mean of 29 months (SD=17, range:6-70months) through interview to examine fatigue experience after treatment, resulting in response rate 59%. Fatigue severity was measured by the fatigue severity subscale (CIS-fatigue) and severe fatigue was defined as CIS-fatigue scores $\geqq 35$. Severely fatigued disease -free reported less physical functioning and psychological well-being, more functionally and neuropsychologically impaired, experience less social support, and had a lower sense of control related to their fatigue complains than did non-severely fatigued disease-free breast cancer patients (all $p < 0.001$)(Servaes et al., 2002).

Perceived health status. Perceived health status is defined as a subjective, multidimensional outcome state in which health perceptions and physical, mental, social/ role-functioning and well-being are influenced. Bandura (1977) stated the measurement of health state might determine one's capability level for exercise and thus limit self-direction of exercise behavior. Perceived poor health status has been associated with less exercise and less overall activity in older adults (Jette et al., 1998; Resnick, 2000, 2001; Resnick et al., 2000; Resnick & Spellbring, 2000; Wolinsky, Stump, & Clark, 1995). For example, Jette et al. (1998) investigated 102 sedentary, functionally limited, community-dwelling adults (mean age=75.3± 7.4) who participated in a home-based resistance-training program over 26 weeks (30 minutes/session, 3 times/week, each exercise calendar for a 2 week period, total 26 weeks). Exercise adherence was defined as "the number of calendar periods that subject exercised at least half the number of desired sessions (a minimum of 3 of 6 sessions over the 2-week period) with agreed upon level of resistance divided by the total number of calendar periods. Physical factors were assessed by functional mobility (a timed "up and go" test), muscle strength (using a calibrated, handheld dynamometer), and medical history. Overall, this sample achieved an average participation rate of 93% of the recommended exercise sessions. The result revealed that healthy older adults are more physically active than those in poor health or those who perceive themselves to be in poor health. However, the number of preexisting medical conditions was not related to degree of exercise participation. It should be noted that this sample of volunteers was well educated (61% - had some college or more). The extent to which these findings can be generalized to less educated older persons needs to be explored in future research (Jette et al., 1998).

Health concerns were identified as one factor which influenced the desire and ability to exercise in focus groups of European American women and African-American women (Nies, Vollman, & Cook, 1998, 1999; Walcott-McQuigg & Prohaska, 2001). Eyler et al. (1998) collected qualitative data on ethnic minority groups of women (8-10 women / per group x 10 focus groups) more than 40 years of age (i.e., Filipino- American, Chinese-American, American Indian, Black, Hispanic). Health concerns were the second most frequently mentioned barrier to exercise and the majority of the health concerns were chronic conditions such as arthritis or heart problems (Eyler et al., 1998).

Lower perceived general health was associated with more severe CRF experienced by breast cancer women receiving chemotherapy (Berger, 2001). CRF was consistently correlated inversely with activity levels (Mock et al., 1997) (Berger, 1998) (Dimeo, 1999). A prospective, descriptive, repeated measures study investigated 72 women receiving chemotherapy after surgery for stage I or II breast cancer (Berger, 1998). The Piper Fatigue Scale was used to measure fatigue 48 hours after each treatment and at treatment cycle midpoints for three cycles. The findings reported that total and subscale fatigue scores were significantly different over time, with scores higher at treatments and lower at cycle midpoints. Fatigue was negatively correlated with activity levels and positively correlated with awakenings at night.

Servases and colleagues (2002) investigated how the physical, psychological, social, cognitive, and behavioral dimensions contribute to chronic fatigue in a sample of 150 disease-free breast cancer survivors and a sample of 78 women without a history of cancer (control group). They used 20-item Checklist Individual Strength (CIS) (scored on a seven-point Likert scale) to measured for fatigue severity. Physical activity was measured with the physical functioning subscale of the QLQ-C30, the physical activity, subscale of the CIS, and the mobility and ambulation subscales of the Sickness Impact Profile. The group of patients who had a CIS-fatigue score of 35 and higher were referred to as "severely fatigued disease-free breast cancer patients." (p.590). The other patients were referred to as "non-severely fatigued disease-free breast cancer patients." (p.590). The mean CIS-fatigue score of the breast cancer survivors sample (28.5 ±13.6) was significantly different from women in the control group (19.4 ± 11.0) (t-test, $p<.001$). Fifty-seven breast cancer survivors (38%) and nine women (11%) in the control group met the 'cut-off' criteria for severe fatigue. The severely fatigued disease-free breast cancer patients reported less physical activity on all used measures compared with non-severely fatigued disease-free breast cancer patients (physical function; $p< .001$; physical activity: $p< .001$; mobility: $p=.003$; ambulation: $p< .001$; daily activity score: $p< .001$) (Servaes et al., 2002).

Self-efficacy. Self-efficacy is defined as a person's belief in his ability to perform a specific behavior required to produce an outcome (Bandura, 1986, 1997). Bandura (1997) stated that individuals with a high sense of self-efficacy are more likely to adopt or engage in exercise on a regular basis than those with lower self-efficacy (Bandura, 1997). The role played by self-efficacy in adhering to exercise has received a great deal of attention. However, it is important to realize that self-efficacy is not concerned with the actual skills that an individual possesses but rather the individual's judgment of what he or she can do with those skills (Bandura, 1986). In the exercise domain, recent reviews suggested that at least 2 specific types of self-efficacy be assessed, task self-efficacy and scheduling self-efficacy, when the study tried to predict exercise behavior (Gyurcsik, Estabrooks, & Frahm-Templar, 2003).

Exercise self-efficacy has been the strongest and most consistent predictor of exercise behavior (McAuley, 1992; McAuley, Courneya, Rudolph, & Lox, 1994; Sallis et al., 1992)). Keller and colleagues (1999) reviewed 44 published studies from the years of 1990-1998. Key words that related to social cognitive theory, self-efficacy, physical activities, and exercise were combined and searched. Sixteen studies were excluded because of lack of quality, lack of clear specification of the use of SCT as a theoretical focus, lack of specificity in both physical activity and construct measurement, and physical activity embedded in other health outcomes. The majority of studies (n=14) were descriptive correlational or observational and only two intervention studies used randomly assigned groups. All of the descriptive studies found a statistically significant relationship between self-efficacy and exercise behavior, and intervention studies designed to increase exercise self-efficacy demonstrated a significant increase in exercise behavior. For those studies that used multiple regression as part of their statistical analysis, the explained variance of self-efficacy for exercise behavior ranged from 4% to 26%. In addition, self-efficacy was found to be related to the maintenance of exercise in many studies, whereas it was related to exercise initiation in only one study.

However, there are several problems that must be considered when interpreting findings from these studies. First, lack of specificity in measuring specific types of exercise self-efficacy and resulting variation in the self-efficacy scales was found in these studies. Most scales failed to differentiate between exercise and physical activity, work and leisure time activity, and aerobic and isometric activities. Second, the differential focus on physical activity versus exercise among these studies resulting in the lack of consistent exercise outcome variables making it difficult to generalize the results. Third, most measures of physical activity were self-reported and might be biased, compared to objective assessments. Finally, without strong evidence from randomized controlled studies, generalizability of findings, and prediction of self-efficacy and its effect are difficult (Keller, Fleury, Gregor-Holt, & Thompson, 1999).

Wu and Pender (2002) examined the relationships among interpersonal influence (i.e., social support, norms, modeling), behavior-specific cognitions (i.e., self-efficacy, perceived benefits/barriers), competing demands, and physical activity among Taiwanese adolescents (N=832). Physical activity was measured with the Child/Adolescent Activity Log. The social support subscale adopted from Child/Adolescent Social Support Scale. Self-efficacy was measured by 14-item Bandura's Exercise Self-Efficacy Scale. Reliability of all instruments was adequate, whereas validity was not provided. They reported that self-efficacy was the strongest predictor of physical activity ($\beta = .44$, $p < .05$) (Wu & Pender, 2002). Only a small percentage of total effects of interpersonal influence on physical activity were direct, with 83% of the total effects resulting from indirect routes through self-efficacy and perceived benefits. Because of the cross-sectional design in this study, casual relationship could not be established.

The predictive nature of various demographic variables on self-efficacy has been reported (Clark, Patrick, Grembowski, & Durham, 1995). Self-efficacy may be different by gender. Godin (1985) surveyed 44 female and 41 male current and retired university employees and results showed that males had significantly higher physical self-efficacy and perceived physical ability than women (Godin & Shephard, 1985). Daly and his colleagues (2002) reviewed several studies and found that female patients have been identified as less efficacious and less able to tolerate physical activity than men (Daly et al., 2002).

Education and age may have a long-term influence on individuals' subsequent life events and self-competence beliefs (Clark et al., 1995; Wilcox & Storandt, 1996). Clark and colleagues (1995) investigate the direct and indirect associations of socioeconomic status with exercise self-efficacy. A total of 5011 seniors were contacted to participate in the study and enrolled (Clark et al., 1995). The sample was largely white and middle class with mean age 72.8 years (SD=5.5). Direct associations of age and education on exercise self-efficacy were found. Those seniors who were younger and more educated were more confident about exercise involvement. Indirect associations of age, income, education, and occupation on exercise self-efficacy operated primarily through previous exercise experience, satisfaction with amount of walking, depression, and outcome expectations. Nonetheless, a single-item, global measure of exercise efficacy and outcome expectations might not measure operational definitions of these two variables very well. In addition, generalizability of the findings of this study is further limited by a low response rate (54%, n=2713) and a sample consisting of mainly white, middle-class persons.

Self-efficacy has been found to be related more strongly to initiating an exercise regimen than to sustaining one (Bandura, 1997; McAuley, 1992; McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003; Oman & King, 1998). One-hundred three middle-aged sedentary adults (mean age=54 years) participated in a 5-month exercise program. McAuley (1992) examined the role of self-efficacy and past behavior (attendance) in adherence to exercise behavior. Three measures of exercise behaviors were assessed— attendance for the frequency aspect of exercise, ratings of perceived exertion, and exercise heat rate for intensity. She observed exercise self-efficacy successfully predicted attendance patterns at 3 months but not at 5 months. At 5 months, past behavior (attendance) was a more powerful predictor of future exercise behavior than self-efficacy (McAuley, 1992). McAuley et al. (1994) conducted a randomized clinical trial to examine the effects of an efficacy-based intervention in enhancing exercise adherence for a 5-month walking program in a sample (N=114) of formerly sedentary middle-aged adults. Attendance (percentage of total exercise sessions that subjects attended over a 20 week program), duration of exercise participation at each session, and distance covered in each session were assessed.

Self-efficacy was measured at the end of months 1, 2, and 4. They found that initial self-efficacy played a significant role in predicting exercise adherence at 2 months (R^2= .18, p<0.01) and efficacy at 2 months predicted exercise frequency at 4 months (R^2= .09, p<0.05), but not efficacy at 4 months. Self-efficacy appears to play a more potent predicting role in the earlier, more demanding stages of the exercise process than it does in later stages (McAuley et al., 1994).

Past exercise history, social environment, and the affective experience of the exercise participation may play important roles in generating exercise self-efficacy. McAuley and colleagues (2003) conducted a 6-month randomized controlled trial to examine the effect of walking and stretching/toning activity on changes in self-efficacy to overcome barriers and engaging in activity in sample of 174 sedentary adults (mean age=65.5±5.35). Structural modeling analyses revealed significant direct effects of physical activity, affect experienced during activity, and exercise social support on both types of self-efficacy. These relationships were not significantly different between walking and stretching/toning activity (McAuley et al., 2003). Turner et al.(1997) manipulated the social environment of the physical activity setting by providing either a socially enriched or a bland leadership style in an effort to influence perceptions of capabilities and affective responses. Results showed that there were significantly increases in self-efficacy, revitalization, and positive engagement across conditions, but, in the case of efficacy and revitalization, these increases were significantly greater in the socially enriched condition.

Jerome and colleagues (2002) conducted a study to manipulate exercise self-efficacy in a laboratory to examine its effects on feeling state response evaluated by the 12-item Subjective Exercise Experience Scale (SEES) (three dimensions: positive well-being, psychological distress, and fatigue) and the Activation- Deactivation Adjective Check List (ADACL) (four subscales: energy, tiredness, tension, and calmness) before and after exercise. Exercise self-efficacy scale consisted of six items and possible scores ranged from 0 to 100. A sample consisting largely of Non-Latina White and Latina college-age women (n=59) (mean age =21.3± 2.74) were randomly assigned to either a low efficacy (LE) (n=30) or high efficacy (HE) (n=29) false feedback condition which was manipulated by computer. With respect to the SEES subscale, there was a significant main effect for time ($p<.01$) and efficacy condition, ($p<0.05$). For efficacy manipulation effect, participates in the HE condition reporting significantly lower distress and fatigue, and greater positive well-being and energy than those in the LE condition. For AD ACL subscales, there was also a significant main effect for time ($p<0.01$) which suggested significant increases in energy and calmness and reductions in tiredness over course of the exercise session (Jerome et al., 2002).

Outcome expectancy. Outcome expectancy is the belief that a certain consequence will be produced by performing specific behaviors (Bandura, 1997). It is a person's belief that exercise will yield physical (i.e., decrease levels of fatigue), psychological effects (i.e., decrease levels of depression), social consequences (i.e. exercise in the group increases social interaction), and internal self-rewards (i.e. increase self confidence) (Dzewaltowski, 1994). Several researchers have reported that those who exercise believe it will produce positive outcomes (Conn, 1998; Dzewaltowski, 1994; Neuberger, 1994; Resnick, 2000, 2001; Resnick, Orwig, Magaziner, & Wynne, 2002; Resnick et al., 2000).

Theoretically, self-efficacy accounts for most of variance in exercise behavior. Empirically, however, outcome expectations may contribute different variance in exercise behavior among different populations. Two studies in older populations reported that outcome expectations were better predictors of exercise behavior than self-efficacy (Resnick, 2000) (Resnick, 2001). It is possible that for older adults the decision to engage in and adhere to a regular exercise program has more to do with benefits derived from exercise than their belief in their capability to perform the exercise activity. In addition, outcome expectations may be a weak variable to predict exercise behavior in young adults.

Rovniak and her colleagues (2002) used a prospective design to test a model of the relationship between social support, self-efficacy, outcome expectations, self-regulation, and physical activity in a sample of 277 university students at 8-week follow-up (time1: baseline; time 2: week 8). There were no significant differences in any measured variables between those participants who returned and those who did not. The sample had a mean age of 19.56 (SD=1.39), was 69% women and 83% white. Social support was measured with the 5- item Friend Support for Exercise Habits Scale. Self-efficacy was measured with the Making Time and Resisting Relapse subscales from 12-item Self-Efficacy for Exercise Behavior Scales. Outcome expectation was measured with an expanded version of the Benefits of Physical Activity Scale and with the Physical Activity Enjoyment Scale. Physical activity was measured with the Stages of Change for Exercise Behavior Scale and a slightly modified version of Aerobics Center Longitudinal Study Physical Activity Questionnaire. Reliability of all instruments was adequate, whereas validity was not presented. The investigators reported that self-efficacy had the greatest total effect on physical activity (β_{total}=.71, p<0.01) and social support exerted a moderate total effect on physical activity, mediated entirely by self-efficacy ($\beta_{(total/indirect)}$= .28, p< .001). Outcome expectation measures was correlated with physical activity (r= .39, p< .01) but did not explain significant additional variance in young adults' level of physical activity (β_{total}= .21)(Rovniak, 2002).

Environment

Environmental factors that can affect exercise adoption and maintenance include exercise facilities (e.g., distance, numbers of facilities), social support (e.g., types of function, resources), barriers (e.g., safety of the surrounding environment, time constraints, climate condition and caregiving duties) and culture (urban or rural areas).

Facilities. Exercise facilities have been studied in relation to exercise, but results have been mixed. For supervised programs, most studies showed that participants who lived closer to the facility were less likely to drop out. A facility-rich environment (i.e., better exercise equipment) could encourage physical activity and nearby facilities reduce some of the barriers associated with exercise. A random sample of 2,053 residents of San Diego was surveyed regarding exercise habits and the impact of 385 exercise-related facilities on their exercise habits. The mean age of subjects was 47.8 years (SD=16.5), the mean years of education was 14.9 (SD=2.8), 42% of subjects were women, and 39% reported exercising vigorously at least three times per week (Sallis et al., 1990). Almost half of the sample reported exercising at home and fifty-one percent of the sample reported exercising at facilities that were represented in the survey. Exercisers ($\geqq$3 times/per wk) reported a statistically greater number of pay facilities (within 5 km) near their homes than those who were sedentary subjects ($P < .05$ to $P < .01$). However, access to exercise facilities may be related to exercise levels for some individuals but not for others. For those individuals who prefer exercise such as walking or running, which can be done at many locations, access to pay facilities may be less relevant.

Stahl and colleagues (2001) examined the relationships between physical activity and perceived support for physical activity in the physical environment and policy (facilities, programs, and other opportunities), and in the social environment in a sample of 3,342 adults from six countries (Belgium, Finland, Germany, The Netherlands, Spain, and Switzerland). The investigators were surprised that a supportive physical and policy environment was not significantly associated with physical activity participation in any of these countries cultures (Stahl et al., 2001).

Social support for exercise. Social support is defined as "the comfort, assistance, and/or information on receiver through formal or informal contacts with individuals or groups" (Wallston, McMinn, Katahn, & Pleas, 1983, p.369). In Langford and colleagues' (1997) conceptual analysis of social support, they identified social network, social embeddedness and social climate as antecedents of social support. They concluded that " without a structure of people (network) with the quality of connectedness (embeddedness) required to generate atmosphere of helpfulness and protection (social climate) social supportive behaviors can not occur" (Langford, Bowsher, Maloney, & Lillis, 1997, p. 97).

Winemiller and colleagues (1993) pointed out that, " if researchers are interested in a particular aspect of social support they are encouraged to identify, specify, and measure this aspect," rather that using the broader measures available (p.644). Sallis and colleagues (1987) postulated the importance of having specific measures for social support for exercise. They investigated a sample of 154 college students and 17 health professionals and found that a measure of support for exercise was more important for predicting exercise than was a measure of general social support. Further social support research targeting exercise behavior would approach social support from a micro-level rather than from a global level. It can clarify an understanding of the role of social support in exercise behavior to provide more effective interventions.

The definition of social support specific to exercise is also varied. King and Frederiksen defined social support for exercise as "the presence of interpersonal liking, attraction, and group cohesiveness among individuals exercising together"

(King & Frederiksen, 1984), p.5). Cutrona and Russell (1987) defined social support as incorporating six components: a) "attachment" refers to whether or not an individual feels that she/he has a close emotional bond with another person; b) "social integration" addresses whether an individual perceives that she/he is a member of a group with common interests and concerns; c) "reassurance of worth" refers to whether or not an individual feels valued, loved, and appreciated as a person; d) " reliable alliance" refers to tangible assistance or whether a person feels she/he can count on another person for financial help, goods, or services in times of need; e) "guidance" is an individual's perception that there is at least one person who can be depended on for information or advice; and f) "nurturance" refers to reciprocity of social support or whether an individual provides support to other people (Cutrona & Russell, 1987). In addition, Sallis and colleagues (1987) operationalized social support for activity by asking participants to rate supportive behaviors by friends and family. Social support for physical activity also can be instrumental (e.g., taking people to an exercise class); informational (sharing information about a community exercise program); emotional (e.g., calling a friend to see how his/hers exercise program is progressing); or appraisal (e.g., providing encouragement or reinforcement for exercise) (Berkman, 1995).

Chen (1998) used a cross-sectional design to examine the differences in primary motives for participation in physical activities and exercise between 289 Chinese students (55 men and 134 women; mean age= 21± 1.7) in China and 180 American students (93 men and 87 women; mean age= 22± 2.9) in the United States. Frequency and duration of activities were multiplied together, so that the total number represented an individual's current level of participation. The motives for participating in physical activity and exercise were assessed by a 30-item scale. Validity and reliability of the scale were provided. Three factors derived from factor analysis of the data were weight/body management, mental health, and social interaction. The findings indicated that American subjects spent significantly more time participating in physical activity and exercise than did Chinese subjects, and men participated more than women. The major motive for engaging in exercise for Chinese women was to interact socially with each other. In contrast, American college women participated in exercise for managing body weight (Chen, 1998).

Additional research also suggests that there might be gender differences in the effect of social support on exercise (Troped, 1998). There is evidence that social support may be more influential for women, especially support from the family (Sallis et al., 1992; Treiber et al., 1991).

Sources of support for exercise include family members, friends, neighbors, coworkers, health care providers, exercise program leaders and participants, and media. To some degree, social support to exercise from family and friends has been significantly and positively associated with increasing involvement in exercise (Booth, Bauman, Owen, & Gore, 1997; Eyler et al., 1999; Felton & Parsons, 1994; Plotnikoff, Brez, & Hotz, 2000; Rhodes, Martin, & Taunton, 2001; Sallis et al., 1992; Stahl et al., 2001; Sternfeld et al., 1999; Treiber et al., 1991). Spousal social support also may increase levels of physical activity (Daltroy &

Godin, 1989; Godin & Shephard, 1985; O'Reilly & Thomas, 1989; Wallace, Raglin, & Jastremski, 1995).

Eyler and colleagues (1999) conducted a modified-random sample telephone survey of 2,912 black (n=745), Hispanic (n=660), American Indian/Alaskan Native (n=738), and White women (n=768) age 40 and older. The response rate was 91%. They collected four types of physical activity measures; sedentary (no exercise in the past two weeks), regular exercise (at least 5 X a week, at least 30 min per session), cumulative exercise (an accumulation of 150 min of participation in exercise, sports, or physically active hobbies per week), and lifestyle activity (participant accumulated 300 min/ wk of combined physical activity from leisure, housework, and occupational categories. The physical activity social support questions were derived from Sallis et al. (1987). The sampling and survey method was pilot tested, analyzed and revised but was not presented in this study. The findings indicated that participants in the medium or high support categories were less likely to be sedentary than those with no/low support [medium: OR= 0.57 (0.46- 0.72); high: OR=0.47 (0.38-0.58)]. When race was regarded as a potential confounder, the odds ratios remained significant (OR: 0.36 and 0.33 respectively). There was no significant difference between the contribution of "friends" support versus "family" support on all four measures of physical activity in this study (Eyler et al., 1999). Limitations of this study were the use of a cross-sectional design and the survey data were collected via telephone, which limited the sample to households with a phone. Treiber et al.

(1991) reported a difference in family and friends support between two races. White women's sports and leisure activities were positively associated with friend support and black women's sports activity was positively associated with family support (Treiber et al., 1991).

It should also be recognized that the relationship between exercise and social support is a dynamic process in which sources of social support may change over time (Oka, King, & Young, 1995). Bandura (1986) contended that self-efficacy served as a mediational role in the relationship between social support and health–promoting behavior such as exercise in the context of an at risk population of sedentary middle-aged men and women (Bandura, 1986). This is in accordance with results of one cross-sectional and three prospective studies—social support failed to influence exercise behaviors directly but did so indirectly through the mediation of self-efficacy (Duncan & McAuley, 1993; Duncan & Stoolmiller, 1993; Resnick et al., 2002; Rovniak, 2002).

While the impact of physicians' recommendation of exercise participation is potentially great, little effect has been documented (Reed, Jensen, & Gorenflo, 1991). The professionals empower patients by taking time to talk to them, answering questions, offering helpful information and listening. Booth, Owen and Gore (1997) surveyed 2,298 Australian people (three age groups-18-39; 40-59; 60-78) for preferred sources of support to exercise. The two most preferred sources of help were: 1) receiving advice on appropriate activities from doctors or other health professionals (38% of all respondents) and 2) having the opportunity to exercise with a group (31% of all respondents). Among those aged 18 to 39 years, more than 40% wanted to exercise with a group. More than 40% of those aged 40-59 years and 50% of those aged over 60 years wanted professional advice (Booth et al., 1997).

Segar et al. (1998) also found that 50% of breast cancer survivors were not counseled to exercise by their physicians. The amount of exercise performed by breast cancer survivors who received a physician recommendation to exercise was significantly higher than that of women who did not receive such a recommendation (Segar et al., 1998).

Barriers. Although people possess positive views concerning the benefits of being active, individuals may not actually perform exercise if they perceive various barriers that cannot be overcome. The potential importance of environmental factors influencing physical activity participation was mentioned by several focus groups or found by research results. These environmental factors included safety of the surrounding environment, time constraints, climatic condition and caregiving duties (Addy et al., 2004; Eyler et al., 1998; Nies et al., 1998, 1999; Walcott-McQuigg & Prohaska, 2001). Seefeldt et al. (2002) addressed that time devoted to childcare, physical labor as an occupation, lack of transportation, unsafe neighborhoods, and inflexible work schedule can contribute to lower exercise participation rates (Seefeldt, Malina, & Clark, 2002).
Barriers to exercise are specific to different ethnic groups. For instance, offering the exercise in different seasons and holidays may have affected the results.

Because gyms are not popular in Taiwan, most people exercise in outdoor environments, where women's interpersonal family, vocational relationships and emotional state can be affected by the winter season-long dark days and cold precipitation. Women who work outside the home may spend more time on exercise during long weekend or holidays such as Chinese Lunar New Year.

King et al. (2000) conducted a one-year follow-up telephone survey to exam personal and environmental barriers to physical activity among a U.S. population-derived sample of 2,912 women 40 years of age and older. Physical activity was categorized into three levels (sedentary, underactive, and active) of leisure-time or household-related physical activity engaged in over the past 2 weeks. Sedentary was defined as no exercise reported or no increase in heart rate reported from any activities engaged in. Underactive was defined as not meeting the criteria for either the sedentary or the active category. Active was defined as either three or more sessions per week for at least 20 min per session of jogging, hiking, biking or dance resulting in a medium to large increase in reported heart rate, or five or more sessions per week for at least 30 min per session of any physical activities such as walking or gardening.

King's sample was 56.9% married, 58% completed high school or less, 34% completed university, 37.4% worked full time, and 25.3% retired. Each of the four racial-ethnic subgroups (White, African American, American Indian, and Hispanic) constituted approximately one quarter of those sampled. For the sample as a whole and across each racial-ethnic subgroup, care-giving duties and a lack of energy to exercise ranked among the top four most frequently reported barriers to exercise. This finding indicates the potential impact of this increasing frequent life role on health behaviors for women in this age group and underscores the need to identify the types of physical activity regimens that are most appropriate to the care-giving situation. Moreover, lack of time and feeling too tired to be physically active ranked among the top four barriers for three of the four racial-ethnic subgroups. White subgroup had barriers that included greater age, less education, presence of hills, and lack of energy. African American women had barriers of greater caregiving duties, and the presence of unattended dogs in one's neighborhood. American Indian women had barriers of less education and self-consciousness about physical appearance. Hispanic women's barriers included less education, discouragement from others, too tired to exercise, and presence of hills in one's neighborhood.

There were some limitations with this telephone survey, however, including undersampling of some minority and low-income groups who lack telephones, excluding those who did not possess sufficient English language skills to participate. Moreover, only a subset of possible environment influences was assessed in the survey, based on few systematic investigations currently reported in the literature, rather than participants' perceptions that the environment variable influenced their behavior. Because it is not clear whether the actual or perceived environment is more influential, it is important for future studies to evaluate both aspects. In addition, the study used a cross-sectional study. Therefore, causal inferences can not be made.

Summary of Research on Determinants of Exercise

Regular participation in exercise must be viewed as a dynamic process in which adoption and maintenance of involvement are key outcomes. It is not possible to specify all important interactions among known determinants at this time. However, it appears that some determinants directly influence exercise behavior while others operate indirectly through mediators. Self-efficacy and outcome expectancy show a consistent positive association with exercise behavior and appear to be major determinants of exercise involvement. Self-efficacy plays a potent role in the adoption phase of exercise behavior than in the maintenance phase. Outcome expectancy may explain more variance in exercise behavior among the older population. Relationships between exercise behavior and sociodemographic factors such as age, gender, martial status and occupation, are mixed and need more evidence. Personality, affective state, exercise history, perceived health, and education are consistently, directly or indirectly, associated with exercise involvement. Furthermore, few studies have examined environmental or policy factors, and these factors need greater study. Also individual barriers to exercise need further examination in order to implement effective interventions. In addition, social support seems to be an overwhelmingly positive determinant of maintaining exercise regardless of gender or cultural factors. Interventions that enhance and maintain these social support networks may be an integral part of effective exercise programs for women survivors of breast cancer.

To date, participants in previous studies have largely been volunteers drawn from samples of breast cancer patients. As is typical of survivors' profiles, participants in the studies reviewed have been primarily white, middle-to upper socio-economic class and well educated. Investigators should begin to identify methods to recruit and retain subjects with a more diverse demographic profile.

Despite the important theoretical and practical findings from these studies, there are limitations that warrant mentioning when interpreting the results. First, the importance of experimental design; only a true experiment uses the methodology necessary for causal relationships. However, few studies used RCT design. Half of studies investigating the relation between those factors and exercise behavior have been cross-sectional, which give less confidence about how these factors influence people's level of exercise. Second, there are many different outcome measures of exercise behavior or physical activity, such as adherence (attendance, intensity, duration), Stages of Changes Scale, types and levels of exercise, fitness change, energy expenditure, self-designed questions, may draw different conclusions. Forty percent of studies used adherence as the outcome measure. In light of the wide variability of exercise behavior measures designed to address the adherence issue across various studies, increased attention needs to be given to the issues of how best to define exercise behaviors. As Martin and Dubbert (1982) have stated, the measure of adherence should reflect the construct of interest. Therefore, if frequency of activity is considered the most important aspect of physical activity for a particular group of individuals, then assessment of attendance is a logical means of determining whether this goal was achieved.

Attendance at exercise sessions has been the most common index of adherence to exercise behavior utilized in most studies. Although attendance appears to be an adequate measure of an individual's adherence to exercise regimens, it is only so if the exercise is performed at levels of duration and intensity sufficient to achieve the program's health objectives. In addition, most of studies used the self-report assessment of exercise which is more open to bias than objective indicators of physical activity. Future research may use objective activity monitors to verify levels of exercise behavior.

Finally, several studies reviewed used a single-item scale to measure multidimensional constructs (e.g., social support, exercise history, fatigue). Single-item scales are common in research on exercise but provide inadequate or unstable measures. Similarly, the use of a barrier self-efficacy (DuCharme & Brawley, 1995) measure may not reflect the complete construct of self-efficacy to exercise, as scheduling self-efficacy has also been found predictive of exercise among middle-aged adults (DuCharme & Brawley, 1995). Measures of exercised-related efficacy based solely on one dimension may underrepresent the efficacy concept in this behavioral domain. The use of the barrier measure alone would accounts for less explained variance in exercise attendance. However, relationships between self-efficacy scores are quite reliable despite differences in how the concept is measured.

The present study described later attempted to account for some of the limitations of previous studies. Although various empirical approaches have achieved some limited success in the promotion of exercise behavior, there continues to be a need for further studies based on established theoretical frameworks. Researchers exploring how individuals come to adopt and maintain exercise have found some success by examining the relationship between exercise behavior and a number of the theoretical constructs derived from Theory of Planned Behavior (TPB)(Ajzen, 1985), Transtheoretical Model (TTM) (Prochaska & DiClemente, 1983) and Social Cognitive Theory (SCT) (Bandura, 1986). These three models have received the most empirical attention to date relative to exercise behavior. However, the majority of TPB research has focused on the prediction of intention to exercise, rather than on the exercise behavior itself; TTM mainly describes exercise behavior, rather than the specific determinants of exercise behavior. Only SCT goes beyond individual factors in behavior change to include environmental and social factors. Interventions designed using the SCT not only address behavioral change at the individual level, but also addresses changes within the environment that support behavioral change. Therefore, Social Cognitive Theory was chosen as the theoretical framework for the present study to examine the relationship between determinants of exercise and exercise behavior among breast cancer survivors in Taiwan.

This research will extend the current understanding of how SCT can be used to understand exercise behavior in Taiwanese breast cancer survivors. Based on SCT, determinants for exercise behavior include CRF, perceived health status, past exercise history, exercise barriers, social support for exercise, self-efficacy, and outcome expectancy were assessed. The methods and analyses of the present study are presented and explained in greater detail in the following chapter.

CHAPTER III.

Methodology

The Determinants of Exercise Behavior Model (Figure 3.1) was a modification of the Social Cognitive Theory (SCT), a theory developed by Albert Bandura (1986). As demonstrated by the preceding review of the literature, the individual pathways of this model were supported by empirical data that found associations among eleven concepts. These data from previous studies provided evidence for separate model pathways and, in addition, form the theoretical basis for assembling the pathways into the complete Determinants of Exercise Behavior Model. Therefore, this study obtained prospective data to test the relationships between motivating factors and exercise behavior based on this theoretical model.

Purposes

The purpose of this study was to examine the relationship between those factors and exercise behavior among Taiwanese breast cancer survivors based on the Determinants of Exercise Behavior Model. The general objectives of this research were three-fold: (1) to determine if the instruments used in other studies would be culturally appropriate for Chinese women (2) to examine exercise participation over 6 months after adjuvant treatment is completed; and (3) to use prospective longitudinal data to examine the relationship between motivating factors of exercise and exercise behavior among Taiwanese breast cancer survivors based on the SCT.

Specific Aims & Hypothesis

Based on the SCT, and its application to exercise, there were seven aims and hypothesis:

1. Determine if age, education, exercise history, cancer-related fatigue (CRF), perceived health status, social support for exercise and exercise barriers have a direct influence on exercise self-efficacy at baseline.

   Hypothesis I: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise and exercise barriers will make a significant contribution to explaining the variance in exercise self-efficacy at baseline.

2. Determine if age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers and exercise self-efficacy have a direct influence on exercise outcome expectancy at baseline.

   Hypothesis II: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers and exercise self-efficacy will make a significant contribution to explaining the variance in exercise outcome expectancy at baseline.

3. Determine if age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy have a direct influence on exercise behavior at baseline.

   Hypothesis III: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy will make a significant contribution to explaining the variance in exercise behavior at baseline.

4. Determine if exercise self-efficacy, exercise outcome expectancy, and exercise behavior significantly increase over time.

   Hypothesis IV: Exercise self-efficacy, exercise outcome expectancy, and exercise behavior will significantly increase from T1 to T2, T2 to T3, and T1 to T3.

5. Determine if age, education, exercise history, CRF, perceived health status, social support for exercise and exercise barriers at baseline have a direct influence on exercise self-efficacy over time.

   Hypothesis V: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise and exercise barriers at baseline will make a significant contribution to explaining the variance in exercise self-efficacy over time.

6. Determine if age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers and exercise self-efficacy at baseline have a direct influence on exercise outcome expectancy over time.

   Hypothesis VI: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers and exercise self-efficacy at baseline will make a significant contribution to explaining the variance in exercise outcome expectancy over time.

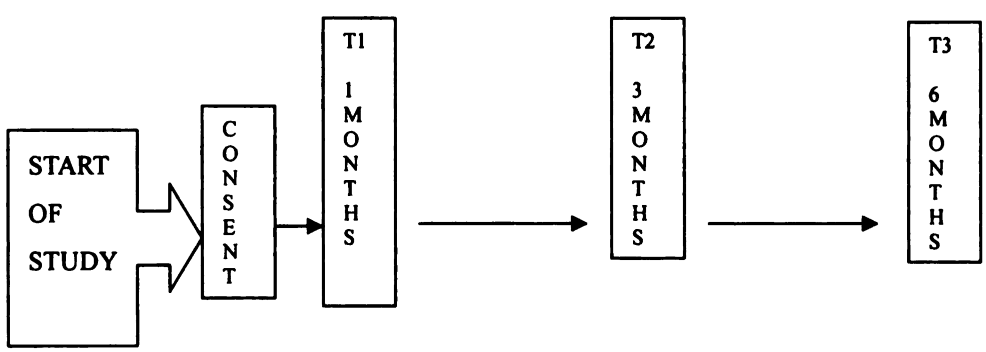
7. Determine if age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy at baseline have a direct influence on exercise behavior over time.

Hypothesis VII: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy at baseline will make a significant contribution to explaining the variance exercise behavior over time.

Research Design

A prospective, longitudinal, repeated measures design (Figure 3.2) was used and standardized instruments was applied to examine correlations between relevant variables and exercise behavior.

Figure 3.1. Study Design



Sample

Sample size

In order to estimate a sample size that would provide adequate power to avoid type II error, sample size was determined by power analysis for multiple regression on Aim one. Level of significance was set at .05, and 12 variables (ethnicity, marital status, employment, disease stage, treatment days, age, education, treatment type, health status, exercise history, barriers, social support) entered the model contributed 28% of explained variance in self-efficacy (Resnick, Zimmerman, Orwig, Furstenberg, & Magaziner, 2001), and CRF was expected to increase 5% of explained variance in exercise self-efficacy indicated that a sample of 108 subjects would produce a power of .80. According to the results from Resnick's study above, 108 subjects were required for data analysis at baseline. To allow for a 15% attrition rate during the study and 20 subjects for the pilot study, 170 subjects were required in this study.

Inclusion criteria.

1. Female, 18 years or older.
2. Confirmed tissue diagnosis of breast cancer.
3. Having a first-time diagnosis of breast cancer.
4. Completed treatment (e.g., surgery chemotherapy, or radiation therapy) except for taking anti-estrogen drug in the remission stage at the time the study commences.
5. Having no history of recurrent disease following initial breast cancer treatment.
6. Mentally able to understand and to complete the written informed consent.
7. Expected survival of at least 6 months.
8. Ability to complete the questionnaires.

Exclusion criteria.

1. Other major disabling medical or psychiatric conditions.
2. Presence of contraindications to exercise as established by the American College of College of Sports Medicine (American College of Sports Medicine, 2000).

Pilot Study

A pilot study was conducted to provide feedback on the Chinese translations of instruments initially developed in English. All of the original study instruments were translated independently into Chinese by the investigator and one native Chinese speaker with excellent knowledge of English. Two criteria were used for agreement upon each common version of the Chinese instruments : (1) the translation should replicate the original as closely as possible in capturing the closest possible meaning for purposes of cross-cultural comparisons; and (2) the translation should also be sensitive to cultural modifications on items that are difficult to translate. These common versions of the forward translation were back-translated into English by one bilingual oncology nursing professional residing in Taiwan. The English versions were compared for equivalence. This process was repeated until satisfactory linguistic or conceptual equivalence was obtained (Frank-Stromborg & Olsen, 1997). A panel of 11 professionals with expertise related to breast cancer or exercise field (five professional experts in nursing, four oncology nurse specialists, one exercise expert and one medical physician who is a breast surgeon in Taiwan) were asked to evaluate the pilot Chinese versions of instruments for appropriateness and relevance of the items.

These eleven experts indicated on a 5-point scale (1= very improper; 2= improper; 3= fair; 4= good; 5= excellent) the extent to which they respond to specific questions about the content relevance of each item. Overall, average mean score of each scale rating from eleven experts ranged between good and excellent (average mean scores range: 4.49 - 4.79). In addition, experts suggested revisions, and identified omissions. Details of content validity score for each instrument were provided in Tables 3.1 & 3.2.

The Chinese versions of instruments were tested with 20 breast cancer survivors. Data from 18 patients were kept, and two patients' data were discarded because substantive changes to the instruments were required. The phrasing and clarity of instruments and order of administration of the instruments were adjusted prior to data collection to ensure instrument appropriateness and feasibility in use in the target population.

All participating study sites were located within three teaching hospitals located in a metropolitan area of north and south Taiwan. Those sites were major resources for breast cancer survivors. Each collaborating study site provided a supporting letter for this study. One research nurse assisted the principal investigator in data collection. She had an eight-year oncology working experience with breast cancer patients, was a case manager in oncology outpatient setting for three years, and conducted follow-up appointments/assessments with breast cancer survivors. She received a copy of the protocol and standardized training in study procedures before initiating the study at the designated site. Methods were standardized across the multiple study sites. The principal investigator monitored the study protocol through periodic site visits and weekly conference calls with the research nurse.

Procedure

Methods of access

A convenient sample of women who were breast cancer survivors was recruited from three teaching hospitals located in a metropolitan area of north and south Taiwan. Potential subjects were identified by the principal investigator (PI) or the research nurse from the hospital log, from the patient lists, or were referred by physicians or other health care providers. PI or the research nurse placed notices and fliers on the boards of oncology outpatient settings, requesting that people interested in this study to contact the researchers. In addition, PI or the research nurse collaborated with physicians in the oncology outpatient settings and got permission from eligible subjects to interview them in a private room at the outpatient settings after they visited the physicians. Those eligible subjects who could not be recruited in person were contacted by mail which included a recruitment letter (Appendix A), a postcard, and the informed consent form (Appendix B). The letter contained the basic information about the study and explained how the person came to be contacted for potential inclusion in the study. A stamped self-addressed acceptance postcard was returned if the subject wished to be contacted about participation. Those who responded affirmatively were contacted in person or by phone by PI or the research nurse and screened for eligibility.

Consent process and documentation

The PI or the research nurse approached all eligible subjects in hospital or outpatient settings in person. The first interview was conducted shortly following completion of all chemotherapy or/and radiotherapy except for Tamoxifen treatment. The median time between the end of treatment and the Time I interview was one month. PI or the research nurse explained the study purpose, procedures, time requirements and the subject's rights to participate or to refuse to participate without jeopardizing her medical care. PI or the research nurse provided the standard consent form to eligible subjects, as approved by Committee on Human Research at UCSF and at the participating facilities in Taiwan. All participants provided consent for themselves before filling out the study questionnaires.

After obtaining informed consent, the participants were asked to complete Chinese versions of the Demographic Profile-Baseline Form, Cancer-Related Fatigue Scale [the revised PFS (Appendix C) at T1, T2, and T3 and LFS (Appendix D) at T2 and T3 only], Perceived Health Status Scale (Appendix E), Social Support for Exercise Scale (Appendix F), Exercise Barriers Scale (Appendix G), Exercise Self-efficacy Questionnaire (Appendix H), Exercise Outcome Expectancy Questionnaire (Appendix I), and Exercise Log (Appendix J) at the day of discharge from hospital. Because subjects needed more time to understand the study and there were many questions (153 items) at Time 1, consultants in Taiwan suggested removing the Chinese version of the LFS-8 at Time 1 which measured general fatigue and was similar to the PFS.

The questionnaires took about 30-45 minutes to complete. All patients who completed the questionnaire (Appendix K) at Time 1 were interviewed again at three (T2) and six months (T3) after baseline (T1). They were contacted by telephone about 1 week prior to remind them of the follow-up visit. The second and third administration of the questionnaires were conducted at the outpatient settings prior to the woman's follow-up visit (Table 3.3). If participants could not be interviewed in person, they received a package by mail including all questionnaires (except for demographic measures). The data collection method included many features that were known to increase response rates including multiple reminders, stamped return envelopes, personalized cover letters with original signatures, assurances of confidentiality, and UCSF sponsorship. PI or the research nurse attempted to contact all non-respondents by telephone to confirm their addresses, or contact those who could not read by phone, or schedule home visits to help them fill out the questionnaires in an interview format. In addition, the medical charts were reviewed to obtain information about stage of disease, type of breast surgery, duration of adjuvant chemotherapy treatment, chemotherapy agents administered, adjuvant radiation therapy and adjuvant hormonal therapy. After completion of the study, subjects received a gift as a thank you for their participation.

Questionnaire-Instruments

Demographic measures (21items- 5 min. to complete). Participants completed the Demographic Profile-Baseline Form. Questions included age, years of education, marital status, family income, employment status, living status, menstrual status and other health problems. Medical variables were obtained from medical charts. These variables were weight, height, body mass index (BMI), bioelectrical impedance analysis (BIA) – a method that sends a harmless electrical current through the body in order to estimate body composition (fat percentage), disease stage, time since breast cancer diagnosis, time since treatment completion, length of chemotherapy treatment, type of surgery, current use of hormone therapy.

Cancer-Related Fatigue-The revised Piper Fatigue Scale (PFS) (27 items-5~8mins to complete). The revised PFS (Appendix C) (Piper et al., 1998) was used to evaluate present patterns of fatigue and took five to ten minutes to complete. PFS was a self-administered scale that was developed from a thorough review of the literature and measurement of symptoms in general and of fatigue and pain in particular. With its strong theoretical foundation, Piper's Integrated Fatigue Model made the PFS unique among existing fatigue measures. Fatigue was defined as subjective feeling of tiredness influenced by circadian rhythm. It can vary in unpleasantness, duration and intensity (Piper et al., 1998). In Piper's pilot study of the original 41-item PFS, the fatigue of 42 breast and lung cancer patients was assessed in the first week of radiation treatment (Rehwaldt, 1998). Patients reported mild fatigue patterns of intermittent and infrequent fatigue. The revised PFS consists of 22 items measuring four dimensions of subjective fatigue. The four factors (dimensions) include the behavioral/severity (six items-item # 2-7), affective meaning (five items-item # 8-12), sensory (five items-item # 13-17) and cognitive/mood (six items- item

#18-23). An 11-point Likert scale was assigned for response to each item and a mean score ranges from 0 to 10. The 0-100 VAS version and a 0-10 numeric scale version had been tested (Piper et al., 1989). The scale was scored by summing the numerical ratings for each response and dividing by the number of responses. These items were used to calculate the four subscale mean scores and a total fatigue mean score in the current study. The revised PFS concluded with five open-ended questions identifying duration of fatigue, perceived causes, relief measures, associated symptoms, and additional fatigue descriptions (Piper et al., 1998). Face and content validity was determined by a review of the literature on pain and fatigue theories by an 11-member panel of fatigue experts (Piper et al., 1998). Piper's Integrated Fatigue Model served as the conceptual framework for this instrument (Piper et al., 1989). Correlations between scores of the PFS, Fatigue Symptom Checklist ($r = .55$), and the Profile of Mood States ($r = 0.42$) showed moderate concurrent validity (Mock et al., 1997). The validity and reliability of the PFS with a reduction in the number of items from 41 to 22 have been confirmed statistically through the use of principal components factor analysis in 382 breast cancer women (construct validity). The items in the revised PFS loaded on the four factors- behavioral /severity, affective, sensory and cognitive/mood. Internal consistency with Cronbach' alpha coefficients has been reported to range from .80 to .98 for the subscales and total scale (Berger & Higginbotham, 2000; Liao & Ferrell, 2000; Woo, Dibble, Piper, Keating, & Weiss, 1998). The standardized alpha for the entire 22-item scale was .97 (Piper et al., 1998). Test-retest reliability of .904 ($p< .0001$) with a two-week time interval was reported in one pilot study of fatigue in an older population involving 46 older ambulatory residents (Liao & Ferrell, 2000).

Lee Fatigue Severity (LFS) (8 items- less than 2 min. to complete). LFS (Appendix D) was tested for general fatigue and was measured only at T2 and T3 to examine the relationship with the revised PFS. The LFS-8, a subset of 8 items from the LFS, was chosen in this study. LFS was developed from the literature and content analysis of interviews with healthy persons as well as sleep clinic patients who complained of fatigue (Lee et al., 1991). A conceptual model of environmental demands and resources resulting in fatigue was the framework used to support the LFS. The model was developed from a secondary analysis of the Woods' Seattle Women's Health Study (Lee, Lentz, Taylor, Mitchell, & Woods, 1994). There were 37 items (adjectives) used initially. The 18 items loaded on the same two factors (energy and fatigue) and 19 items were deleted (Lee et al., 1991). The Lee Fatigue Scale (LFS) is a 18-item scale composed of two subscales: energy (5 items) and fatigue (13 items) (Lee et al., 1991). It measures perception of fatigue and energy with 100 mm lines. These end anchors need to allow for the entire range of sensations to each item affected by fatigue. Average scores can range from 0 to 100 mm. Visual analog format has been converted to numeric rating scale in some recent studies (Aaronson et al., 1999; Miaskowski & Lee, 1999) and the numeric rating scale was used for this study. The LFS-8 scale was scored by summing the numerical ratings for each response and dividing by the number of responses.

Concurrent validity was confirmed by correlating scores with those from the Stanford Sleepiness Scale (SSS) (healthy: fatigue r = .81; energy r = -.76; patients: fatigue r = .73; energy r = -.83) and the Profile of Mood States fatigue-inertia subscale (POMS) (healthy: r = .78; patients: r = .70) and the vigor-activity subscale (healthy: r = .80; patients: r = .56). Principle component analysis was used to identify components (construct validity). Cronbach alpha coefficients for internal consistency for the fatigue subscale ranged from .91 to .96 for the healthy group and from 0.95 to 0.96 for the patient group (Lee et al., 1991). The test-retest for fatigue subscale was .47 and for energy subscale was .77 over 48-hour period in a sample of cancer patients (Meek et al., 2000). The LFS provided sensitivity via computing LFS, POMS and SSS mean scores in healthy subjects to show differences between evening and morning. The LFS fatigue and energy subscales could distinguish between other aspects of mood since they were not significantly correlated (r= .22) with POMS subscales related to depression, tension or anger in a sample of HIV/AIDS patients (Lee, Portillo, & Miramontes, 1999).

Perceived health status (12 items-2mins to complete). Data on subjects' perceptions of their physical health and mental health were collected by using the SF-12 Health Survey (Appendix E)(Ware, Kosinski, & Keller, 1996). The SF-12 was developed from the SF-36 Health Survey for use in monitoring outcomes for general and specific populations. Evidence indicated that the short form is nearly equivalent to the long form in its reliability and validity ((Jenkinson et al., 1997; Ware et al., 1996). This survey form has been shown to yield summary physical and mental health outcome scores that are interchangeable with those from the SF-36 in both general & specific populations. The SF-12 included six items from the physical summary measure (item # 1,2a, 2b, 3a, 3b, 5), namely one item each from the bodily pain, general health and two items each from the physical functioning and role-physical, and six items from the mental summary measure (item # 4a,4b, 6a, 6b, 6c, 7), namely one item each from the vitality and social functioning scales and two items each from the role-emotional and mental health scales. All 12 items were used to calculate the Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12) by applying empirically derived scoring algorithms. The scoring algorithm created orthogonal component scores for PCS-12 and MCS-12. The minimum possible score was 0 and the maximum possible score was 100. Higher scores were indicative of better mental and physical health (Ware et al., 1995, 1996). The SF-12 can use a four-week recall period. Test-retest reliability of physical and mental health scores with a 2-week time interval was .89 and .76 in general U.S. population surveys (n=232). Relative validity coefficients for the physical subscale ranged from .43 to .78 and for mental subscale ranged from .78 to .93 in relation to the best 36-item SF scale (Ware, Kosinski, & Keller, 1996).

Social support for exercise (24 items-4mins to complete). The Social Provisions Scale for Exercise (SPSE)(Appendix F) was a social support instrument revised from the Cutrona and Russell (1987) Social Provisions Scale

(Sproule, 1999). The SPSE is composed of 24 items corresponded to six, four-item subscales (e.g. reliable alliance-item # 1, 10, 18, 23, attachment-item # 2, 11, 17, 21, guidance-item # 3, 12, 16, 19, nurturance-item # 4, 7, 15, 24, social integration-item # 5, 8, 14, 22, and reassurance of worth- item # 6, 9, 13, 20). Subjects indicated on a 4-point scale (1 = strongly disagree; 4 = strongly agree) the extent to which their social relationships currently supplied each of the provisions. For scoring purposes, the negative items were reversed (items: 2, 3, 6, 9, 10, 14, 15, 18, 19, 21, 22, 24) and summed together with the positive items to form a score for each social provision. A total social provision to exercise score was also formed by a total score from summing items had been answered by the subject. Possible scores ranged from 24 (low support) to 96 (high support).

To evaluate the internal consistency reliability of the revised SPSE (17 items-item number 3, 5, 8, 10, 17, 18, 24 had been dropped from 24-item SPSE), analyses were conducted on a sample of 493 women (Appendix-H). The analysis indicated that internal consistencies for the provisions of lack of support (α = .82), reassurance of worth (α = .79), close relationship (α = .76), nurturance (α = .70), guidance (α = .73), and total scale (α = .89) were all adequate (Appendix-J). Construct validity for the 24-item SPSE has been established via confirmatory factor analysis, convergent, and divergent validity. Factor analyses showed a five-factor solution provided the best fit of the data and seventeen items were retained in the final version. Those factors were: a) "lack of support"(4 items); b) "reassurance of worth" (4 items); c)"close relationship"(4 items); d)"nurturance"(3 items); e) "guidance" (2 items) (Sproule, 1999). Analyses of data from a sample of 242 college students supported the convergent validity (e.g., social desirability: r = .124; introversion-extraversion: r = .289) and divergent validity (e.g., depression: r = - .278; neuroticism: r = - .199) of the scales (Cutrona & Russell, 1987).

Perceived barriers to exercise (14 items-2-3 min to complete). Perceived exercise barriers was measured with the Barriers Subscale of the Exercise Benefits/Barriers Scale (Appendix G)(Sechrist, Walker, & Pender, 1987). This instrument was tested on the responses of 650 adults. The scale contains 14 barrier items scored on a 4-point forced-choice Likert format ranging from strongly agree to strongly disagree. The possible range of scores is 14-56 and actual score in a sample of 650 adults ranged from 22-56 with a median of 41. Higher scores indicate that individuals perceive more barriers to exercise than benefits. In this study, a mean score was calculated by summing the numerical ratings for each response and dividing by the number of responses. Mean ranged from 1 to 4. Factor analysis yielded nine factors, five benefits and four barriers, and second order factor analysis resulted in a two-factor solution, a benefits factor and a barriers factor. The barrier factors include time expenditure (i.e., too much time from family relationship; too much time from family responsibilities; takes too much of my time), physical exertion (i.e., exercise is tiring; fatiguing; hard work), family issues (i.e., spouse not encouraging; family not encouraging), and exercise milieu (i.e.: places to exercise are too far away; too embarrassing; cost too much; facilities have inconvenient schedules; people in exercise clothes look funny, and places to exercise are too few). For the purposes of this study eight additional items were included in order to broaden the topics of barriers to exercise. By adding these items, the construct validity of the instrument might be compromised. Internal consistency for the barriers subscales has been reported at .87, and test-retest reliability over 2 weeks was .77. Coefficients alpha ranged from .83 to .86 in studies related to adult, elders, and patients with arthritis (Sechrist, Walker, & Pender, 1987).

Exercise self-efficacy (19 items-3min to complete). Exercise self-efficacy was measured using an exercise-specific self-efficacy scale (Appendix H) designed by Bandura (1997). This instrument contains 19 items and participants rate how confident they are that they can exercise in a variety of situations. For each item, subjects were asked to record the strength of their efficacy beliefs on a 100-point scale ranging in 10-unit intervals from 0 (cannot do at all) through intermediate degrees of assurance such as 50 (moderately certain can do) to complete assurance, 100 (certain can do). The scale was scored by summing the numerical ratings for each response and dividing by the number of responses. Higher scores indicate higher exercise self-efficacy (Bandura, 1997). This instrument has been translated and used on Korean adults with chronic disease (Shin, Jang, & Pender, 2001). Cronbach alpha coefficients for this measure was reported as .94, and test-retest reliability over 2 weeks was .77 (Shin et al., 2001). Several items were tailored to the Korean population. Two items will be added for this study: 1) when I am feeling nausea or vomiting; 2) when I am feeling pain. One item, "after recovering from an injury that caused me to stop exercising" was taken out. One item was modified to "After recovering from cancer that caused me to stop exercising."

Exercise outcome expectancy (9 items-1~2 min. to complete). Outcome expectancy for exercise was measured with the Outcome Expectation for Exercise (OEE) Scale (Appendix I)(Resnick, Zimmerman, Orwig, Furstenberg, & Magaziner, 2000). Initial testing of the OEE measure was conducted in a sample of 175 older adults in a retirement community (Resnick et al., 2000). The scale contains 9 items, which relate to both physical and mental health scored on a 4-point, forced-choice, Likert format ranging from strongly disagree to strongly agree (1-4). The scale was scored by summing the numerical ratings for each response and dividing by the number of responses. Higher scores indicated strong beliefs that beneficial consequences will result from exercise. The following 9 statements were included: 1) makes me feel better physically; 2) makes my mood better in general; 3) helps me feel less tired; 4) makes my muscles stronger; 5) is an activity I enjoy doing; 6) gives me a sense of personal accomplishment; 7) makes me more alert mentally; 8) improves my endurance in performing my daily activities; 9) helps to strengthen my bones. A sample of 191 older adults living in the community was used to obtain evidence for the reliability and validity of the OEE (Resnick, Zimmerman, Orwig, Furstenberg, & Magaziner, 2001). A confirmatory factor analysis provided evidence for validity of the measure. The path coefficients ranged from .57 to .82 and the model fit the data. Evidence of construct validity of the OEE was supported with a statistically significant difference between those who exercised regularly and those who did not. Internal consistency of the OEE scale with an alpha coefficient of .89 and test-retest reliability over 2-week intervals was .76 (Resnick et al., 2001).

Exercise log (21 items-10 min. to complete). Exercise was measured with the Exercise Log (Appendix J). Each subject was carefully instructed on completion of Exercise Log which asked them to record their feeling, daily activity level, appetite, sleep, emotion, meaning of exercise, past exercise history, exercise consultation by health professionals. "Exercise behavior" in this study was defined as any moderate physical activity that do in discretionary time on a regular basis for at least 20 minutes per session, three times per week in a typical week. Subjects was asked to recall the type of daily exercise, frequency of exercise, duration of exercise, and ratings of perceived exertion (Borg scale)(Morgan & Borg, 1976) performed during the past 7 days which was modified by the leisure score index (LSI) of the Godin Leisure Time Exercise Questionnaire (Godin, Jobin, & Bouillon, 1986) and "7 Day Physical Activity Recall Interview Questionnaire" (Blair, 1984). Participant's ratings of perceived exertion were monitored as a subjective indicator of exercise intensity and also to validate that participants were working at a moderate level of intensity (RPE=12-16). The scale ranges from 6 to 20 with modifiers (e.g., 7=very, very light; 15=hard; 19=very, very hard) following each odd integer. Test-retest reliabilities of .80 and higher have been reported, and it has been demonstrated repeatedly that the scale is valid for assessing perceived work intensity (Borg, 1985). Also, weekdays and weekends were considered separately. A list of examples of daily exercise was provided (Blair, 1984). The average of energy spent on exercise per week was calculated by weighting each frequency by its estimated intensity in metabolic equivalents (METs) by total hours and summing for a total score. A MET is a unit that represents the metabolic equivalent of an activity in multiples of the resting rate of oxygen consumption (Ainsworth et al., 2000). One MET is estimated as 1 kilocalorie per kilogram of body weight per hour (Ainsworth et al., 2000). Body mass index (BMI) which was calculated as weight in kilograms/height in square meters (Weigley, 1994) and bioelectrical impedance analysis (BIA) were used as a measure of body fat composition.

Data Management Analysis

Data entry and analyses were performed in SPSS 12.0. Missing data were handled in SPSS by leaving the variable blank, allowing the program to assign an internal missing value. Setting rules for handing missing data that specified the minimum number of non-missing items required for construction of each instruments was established (at least 80% of total items in each instruments should be answered). A p value of < .05 was used for statistical significance. Descriptive statistics and bivariate correlations were used to describe the sample and evaluate relationships among the variables.

Internal consistency reliability was estimated with Cronbach alpha coefficients to demonstrate consistency for total scale scores. Using guidelines set forth by Nunnally (1994), many researchers consider an alpha coefficient of at least .80 to be adequate for a more developed instrument. Very high correlation may reflect redundancy among items or possible items measuring the same dimensions (Frank-Stromborg & Olsen, 1997; Nunnally & Bernstein, 1994).

The Kaiser- Meyer-Olkin (KMO) measures sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed. Values which are greater than 0.8 are considered good. Tabachnick and Fidell (1996) stated that "Bartlett's (1954) test of sphericity is a notoriously sensitive test of the hypothesis that the correlations in a correlation matrix are zero" (p. 641). If the findings are significant, then this means that the entire sample population correlation matrix was not identical. Face and content validity was determined by an 11-member panel of experts. The construct validity of the scales has been supported by factor analysis. An Principle Axis Factoring (King et al.) with varimax rotation was used to identify components. The final components were confirmed using the scree-test criteria. The shape of this curve is used to evaluate the cutoff point for the number of factors.

Generally, continuous data are considered more advantageous than ordinal data because it provides more detailed information. However, only 84 subjects had Cancer-Related Fatigue (CRF) symptoms and therefore, actually answered the Piper Fatigue Scale at baseline, which resulted in one hundred eleven subjects' fatigue to be coded as missing when fatigue was entered into the hierarchical multiple regression equations. The same situation occurred at Time 2 and Time 3. Therefore, an alternative way to deal with fatigue intensity scores was created that would allow all subjects to get a score.

First, the fatigue (completed Piper Fatigue) and no fatigue (did not complete Piper Fatigue) groups were compared on the Physical Component Summary (PCS) and Mental Component Summary (Wu & McSweeney) scores of the SF-12 to check whether there was a significant difference between these two groups. Second, the correlation of the Piper item 7 (fatigue intensity score) and the total Piper score (with and without item 7 in the total score itself) was examined. If there was a high correlation ($r > .70$), then an ordinal version of item 7 would be created that gives all subjects a score that can be used instead of the mean score of the Piper Fatigue score. For this ordinal version of item 7, all of the no fatigue subjects would be scored 0, those subjects that answered item 7 should be recoded so that 0 = 0; 1,2, and 3 = 1; 4,5, and 6 = 2; and 7,8,9, and 10 = 3. Thus, we would have a fatigue intensity score that ranged from 0 to 3 (four levels). A Friedman test was used to examine the ordinal fatigue scores changes over time. If a significant change was found, the Wilcoxon signed rank test was performed to check which fatigue mean rank difference was significantly different from zero.

In order to verify that the Determinants of Exercise Behavior Model is useful as a conceptual framework, several approaches were taken for the data analyses. First, the various relationships hypothesized in the model (such as hypothesis I-III and V-VII) were investigated with a series of hierarchical multiple regression equations. The squared multiple correlation (R^2) was used to evaluate the effectiveness of the optimum combination of predictor(s) in explaining the total variance in a dependent variable. The squared semi-partial correlation (sr^2) was used to evaluate the unique contribution of each specific predictor in explaining the total variance in a dependent variable in the final models.

Because the histogram and the normal probability plot showed that exercise frequency was not a normal distribution, the square root of original exercise frequency scores was used to transform data. In addition, for greater reader comprehension on interactions in the figures, several continuous predictors (such as age, social support for exercise, exercise barrier, exercise self-efficacy) are represented by three ordinal levels from low (a regular dotted line), medium (a straight line), high (an irregular dotted line), where each level represents increases of 33% of the total score (1:0-33%; 2:34%-66%; 3: 67%-100%). For the ordinal version of age, the age of each subject was recoded so that 1 = 23-44 year-old (pre-menopausal women); 2 = 45-55 year-old (peri-menopausal women); 3 = 56-74 year-old (post-menopausal women). For the ordinal version of social support for exercise, all of the women scores was recoded so that 1 = 27-57.9 scores (low); 2 = 58-64 scores (medium) ; 3 = 65-92=3 scores (high). For the ordinal version of exercise barrier, all of the subjects scores was recoded so that 1 = 1-2.049 scores (low); 2 = 2.050- 2.229 scores (medium); 3 = 2.230-3.090 scores (high). For the ordinal version of exercise self-efficacy, all of the subjects scores was recoded so that 1 = 0-3.59 scores (low); 2 = 3.60- 5.17 scores (medium); 3 = 5.18 thru 10 (high).

Second, in order to examine whether exercise self-efficacy, exercise outcome expectancy, or exercise frequency changed over time, a series of linear mixed model (LMM) analyses were conducted with time as the repeated factor to test hypothesis IV. The LMM is an extension of the more familiar repeated-measures ANOVA model and has the advantages of greater flexibility in modeling within-subject correlation, handling random errors both within and between subjects, and greater ability to accommodate a data set with multiple missing data. There are six possible covariance structures (i.e. Simple, Compound symmetric, Autoregressive, Autogressive with random effect, Toeplitz, and Unstructured) that could be used to estimate the actual covariance structure of the data. The two common variance-covariance structures considered in this study are unstructured covariance matrix (UN) and compound symmetry (CS). UN specifies no patterns in the covariance matrix and CS refers to the variances being equal to each other and the covariances being equal to each other, but the values of the variances are not necessarily equal to the values of the covariances. Covariance structures can be objectively compared using goodness-of-fit. Akaike's Information Criterion (Jenkinson et al.) is one of indices of relative goodness-of-fit and may be used to compare models with the same fixed effects but different covariance structures. The model with a smaller AIC value indicates a better fit. If LMM revealed a nonsignificant overall F test on these three variables (exercise self-efficacy, exercise outcome expectancy and exercise frequency), no pairwise test of time was needed. If a significant change was found, pairwise comparison tests, mean difference between all pairs of time points (Time 1-2, Time 1-3, and Time 2-3), were performed to check which set was significantly different from zero. For those dependent variables that significantly changed over time, a series of hierarchical multiple regression equations were used to analyze how the independent variables measured at

CHAPTER IV

Results

Two hundred women met the inclusion criteria for study enrollment. Four women declined to complete the baseline questionnaire because two women were "overwhelmed" by their cancer diagnosis and treatment and two of them had medical problems (major depression) and could not complete questions. One hundred ninety-six women signed informed consent to participate in the study. A total of 196 women completed questionnaires at one month after treatment (baseline-T1), at three months (T2) the sample was 192, and at six months (T3) the sample was 191 from Aug 7, 2003 to Jan.19, 2005. Attrition resulted from unwillingness to continue because of scheduling difficulties (n=2), bone metastasis (n=2), and meningitis (n=1) during T2 and T3 follow-up periods.

Descriptive statistics on demographics at baseline for 196 women are presented in Table 4.1. Women ranged in age from 23 to 74 years with mean age 47.6 ± 9.9 years. Of the women, 39.3% were in age group 40-49, 74% were married, 37% were homemakers, 73% were originally from Fujian Province in Mainland China, 45.4% were Buddhist, 33.2% had completed university/college, and average individual monthly income was NT 20,000~NT 39,999 for 40.4% (1USD=32 NT).

Medical profile of the subjects is presented in Table 4.2. The majority of the women had stage I (26.42%) or stage II (52.33%) breast cancer diagnosis and infiltrating ductal carcinoma was the most common type of breast cancer, accounting for 94 % of breast cancer diagnoses. All subjects underwent surgery and over half (68%) were treated with modified radical mastectomy (MRM) surgery. A small group (4%) did not receive any adjuvant therapy while others received chemotherapy (36%), radiotherapy (5%), or both (55%). Radiation therapy protocols consisted of outpatient external beam treatments scheduled on 5 days per week for 6 weeks plus a booster dose for a total of 50 to 60 cGy. Average days for chemotherapy were 122 days with range 56-182 days, 42 days with range 41-45 days for radiotherapy, and 183 days with range 71-344 days for those having both treatments, respectively. The majority (62%) were treated with Tamoxifen, and 102 women (52%) reported premature menopause due to treatment while 78 women (40%) reported being postmenopausal at the beginning of the study. Almost half of the subjects (40%) had other health problems or a combination of several health problems. The five most frequently reported health problems were hypertension (n=23, 11.7%), osteoporosis (n=13, 6.7%), anemia (n=12, 6.1%), diabetes mellitus (n=11, 5.6%) and limb numbness or bad circulation in the foot (n=9, 4.6%).

Means and standard deviations for the main study variables over time were calculated (Table 4.3). The revised Piper Fatigue Scale (PFS) consists of 22 items measuring subjective CRF. An 11-point Likert scale is assigned for responses to each item and mean score ranges from 0 to 10 (score range = 0-10). At baseline, the mean score on the revised PFS was 4.88 (SD: 2.14) (n=84) (Table 4.3). Factor structure of the PFS items was examined using Principal Axis Factoring (King et al.) with varimax rotation. It was adequately performed (KMO=.89; Bartlett's test Chi-Square= 998.6, p<.001) in participants who completed all 22 items (n=43) and indicated three factors having eigenvalues greater than 1.0. The scree plot, used to evaluate the cutoff point for the number of factors, indicated that the items were classified into three factor categories, and 70.8% of the common variance in 22 items was explained. All 22 items met the criterion of factor loading greater than 0.3 on at least one of the three factors. The first factor accounted for 24.9% of the common variance in the items. The second factor accounted for an additional 24.6% of the variance and the third factor accounted for an additional 21.3% of the common variance in the items. However, the resulting factor-loading pattern was not consistent with the author's (Piper et al.) original subscales including the behavioral/severity (six items), affective meaning (five items), sensory (five items) and cognitive/mood (six items). As expected, all of cognitive/mood items (factor 1), all of the sensory items (factor 2), and all of the affective items (factor 3) loaded together. Unexpectedly, the behavioral/ severity items were loaded into factor 1 (item 2, 3, 4, 6) and factor 3 (item 5 and item 7), respectively.

Internal consistency reliability was performed according to the author's (Piper et al.) original four subscales. The Cronbach's alpha (n=43) for the original subscales were .90 (behavioral/severity); .93 (affective); .94 (sensory); .93 (cognitive/mood); and .97 for the total scale which indicated good reliability even though PFS was used in a different culture resulting in a different factor-loading pattern. Over an interval of 2 weeks, the test-retest correlation coefficients for total scale was 0.74 ($p < .001$) (n=23).

The fatigue (completed Piper Fatigue) and no fatigue (did not complete Piper Fatigue) groups were compared on the Physical Component Summary (PCS) and Mental Component Summary (Wu & McSweeney) scores of the SF-12. The results revealed that there were significant differences between these two groups on PCS ($t_{1, 194}$ = - 5.78, p< .001) and MCS ($t_{1, 194}$ = - 4.78, p< .001). Since the correlation of the Piper item 7 (fatigue intensity score) and the total Piper score (with and without item 7 in the total score itself) were highly correlated (r= .79 and .81), a four-level ordinal version of item 7 was created that gave all subjects a score that was used instead of the mean score of the Piper Fatigue score. Friedman test conducted on this recoded fatigue scores -the ordinal version of Piper item 7 revealed a significant change over time (p<.001). The mean ranks of the recoded fatigue scores for Time 1-2-3 were 2.15, 2.01, and 1.84, respectively. The Wilcoxon Signed Rank test on the three time points revealed that there were two significant differences in T1 vs. T3 (p<.001), and T2 vs. T3 (p= .011) (T1vs.T2: p= .051; criteria α=.05/3= .017)(Table 4.4).

The Lee Fatigue Severity 8-item form (LFS-8), measuring for general fatigue severity, was also tested for validity and reliability in this sample and its association with the Piper Fatigue Scale. The mean score on the LFS-8 was 3.53 (SD: 1.57) at T2. Principal Axis Factoring (King et al.) was adequately performed (KMO=.860; Bartlett's test Chi-Square= 897.68, p<.001) in participants who completed all 8 items (n=189). The results indicated all 8 items loaded on the same one factor and no items were deleted. The factor accounted for 63.5 % of the common variance in the instrument and factor loading for all items were greater than .55. Cronbach' alpha for internal consistency for the LFS-8 was .78 at Time 2 and .82 at Time 3. The test-retest for the LFS-8 was .73 over two-week period (n=23). The correlation between the PFS and the LFS-8 was .76 (p< .001) at Time 2 and .77 (p< .001) at Time 3.

The SF-12 (short-form 12-scale health profile) was used to measure subjects' perceptions of their physical health and mental health, including six items from the physical summary measure and six items from the mental summary measure (Ware, Kosinkski, & & Keller, 1995). All 12 items were used to calculate the Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12) by applying empirically derived scoring algorithms. The PCS mean score was 42.7 (SD: 7.78) and MCS mean score was 46.2 (SD: 11.31) at T1 (Table 4.3). Principal Axis Factoring (King et al.) with varimax rotation was adequately performed (KMO=.82; Bartlett's Chi-Square test = 1052.2, p<.001) (n=194) in participants who completed all 12 items (n=177) and revealed three factors having eigenvalues greater than 1.0, which explained 62.8% of the common variance in the instrument. The results from the scree plot indicated all 12 items loaded on the two mental and physical dimensions. These two factors accounted for 46.5% of the common variance in the 12 items. Internal consistency with Cronbach' alpha coefficients for physical and mental health scores in the current study were .67 and .82, respectively. Test-retest for the PCS was .65 (p=001) and for MCS was .78 (p<.001) over a two-week period (n=23).

LMM analyses conducted on PCS mean scores revealed significant change over time ($p < .001$). According to AIC (2885.3), the compound symmetry (CS) was a better estimate of the actual covariance structures than unstructured covariance matrix (UN). The estimated marginal mean of exercise outcome expectancy for Time 1-2-3 were 42.7 ± .56, 47.3 ± .56, and 48.7 ± .57, respectively. The pairwise comparison tests on the three time points revealed that all three intervals were significant (T1vs.T2: $p < .001$; T2 vs.T3: $p = .014$; T1vs.T3: $p < .001$; criteria $\alpha = .05/3 = .017$) (Table 4.4).

Similar LMM analyses conducted on MCS mean scores revealed that there was significant change over time ($p < .001$). According to AIC (4171.4), the unstructured covariance matrix (UN) was a better estimate of the actual covariance structures than compound symmetry (CS). The estimated marginal mean of exercise outcome expectancy for Time 1-2-3 were 46.2 ± .81, 48.5 ± .77, and 48.9 ± .70, respectively. The pairwise comparison tests on the three time points revealed that there were two significant differences: T1 vs. T2 ($p = .002$) and T1 vs. T3 ($p < .001$) (T2 vs.T3: $p = .035$; criteria $\alpha = .05/3 = .017$) (Table 4.4).

The 24 items Social Provisions Scale for Exercise was used to rate the degree to which the women's relationships with others were currently supplying each of the provisions. The total score on the Social Provisions Scale was 60.8 (SD: 9.51) (Table 4.3). Principal Axis Factoring (King et al.) with varimax rotation was adequately performed (KMO=.78; Bartlett's Chi-Square test = 1537.5, $p < .001$) in participants who completed all 24 items (n=177) and indicated seven factors having eigenvalues greater than 1.0, which explained 50.8% of the variance. The results from the scree plot indicated all 24 items loaded on the five factors, accounting for 47.54% of the common variance. However, the resulting factor-loading pattern was not consistent with the author's original subscales. Six items loaded on " Reassurance of Worth", five items loaded on " Lack of Support", four items loaded on "Attachment/ Guidance", three items loaded on " Nurturance", and four items loaded on " Reliable Alliance". Three items did not load uniquely on a single factor or did not achieve a loading of at least .30. Because Cronbach' alpha coefficients on each subscale was low (.54~ .69), reporting results on separate subscale was not recommended. Internal consistency with Cronbach' alpha coefficients for the total scale was 0.87 (n=172) and the test-retest was .90 (p< .001) over a two-week period in this sample.

Similar LMM analyses conducted on the Social Provisions Scale revealed that there was significant change over time (p=.039). According to the AIC (3955.14), the unstructured covariance matrix (UN) was a better estimate of the actual covariance structures than compound symmetry (CS). The estimated marginal mean of exercise outcome expectancy for Time 1-2-3 were 60.8 ± .68, 61.9 ± .63, and 62.5 ± .62, respectively. The pairwise comparison tests on the three time points revealed that there was a significant difference between T1 and T3 (p=.009) (T1vs.T2: p=.062; T2 vs.T3: p= .281; criteria α=.05/3= .017) (Table 4.4).

The Barriers scale of the Exercise contains 22 barrier items scored on a 4-point forced-choice Likert format ranging from strongly disagree to strongly agree. The mean score on the Barriers scale of the Exercise was 2.06 (SD: .41) (Table 4.3). Principal Axis Factoring (King et al.) with varimax rotation was adequately performed (KMO=.86; Bartlett's Chi-Square test = 1728.9, p<.001) in participants who completed all 22 items (n=161) and indicated six factors having eigenvalues greater than 1.0, which explained 57.3% of the variance. The results from the scree plot indicated all 22 items loaded on the three factors, accounting for 45.9% of the common variance in this instrument. All 22 items met the criterion of factor loading greater than 0.3 on at least one of the three factors. Eight items loaded on three factors that were labeled "barrier from family and life", "barrier from individual factors and weather", and "barrier from environment". The first factor accounted for 17.6% of the common variance in the 22 items. The second factor accounted for an additional 14.3% of the common variance and the third factor accounted for an additional 14% of the common variance in this instrument. The internal consistency estimates for the three subscales and the whole scale were quite strong and alpha coefficients were .85, .83, .80, and .90, respectively. The test-retest for the Barriers scale was .86 (p< .001) over two-week period in this sample.

LMM analyses indicated that there were similar values for the Barriers scale over time (Estimated marginal means ± SE: T1: 2.06± .03; T2: 2.00± .03; T3: 2.03± .03). There was a small decrease between T1 and T2 and an increase at T3 to a level below baseline (T1) assessment. However, the overall change in exercise barrier' scores was not significant over the 6-month period (df=2; F=1.822; p= .170) (Table 4.4).

Exercise self-efficacy contains 19 items measuring subjects' perceived capability to exercise. The mean score on the scale of the Exercise self-efficacy was 4.46 (SD: 1.96) (Table 4.3). Principal Axis Factoring (King et al.) with varimax rotation was adequately performed (KMO=.88; Bartlett's test Chi-Square= 1617.2, p<.001) in participants who completed all 19 items (n=130) and indicated four factors having eigenvalues greater than 1.0, which explained 60.6% of the common variance in the 19 items. The results from the scree plot indicated all 19 items loaded on the four factors and met the criterion of factor loading greater than 0.3 on at least one of the three factors. Those factors accounted for 17.8%, 15.8%, 15.4%, and 11.6% of the common variance in the items, respectively. Cronbach' alpha coefficients for this measure was .93 (n=130) and the test-retest reliability over 2 weeks was .84 (p< .001) in this sample.

Outcome Expectancy for Exercise (OEE) contains 9 items, related to both physical and mental health scored on a 4-point forced-choice Likert format ranging from strongly agree to strongly disagree. The mean score on the OEE was 3.12 (SD: .42) (Table 4.3). To identify underlying dimensions of the OEE items, a Principal Axis Factoring (King et al.) was performed with a varimax rotation (KMO=.87; Bartlett's Chi-Square test = 809.3, p<.001) in participants who completed all 9 items (n=189). One major factor emerged, accounting for 46.7% of the common variance in 9 items (eigenvalues = 4.72). A scree plot also showed one large factor with a relatively horizontal line for all other items. In the current study, the alpha for the OEE was .88 and two week test-retest reliability was .75 (p< .001).

Details of the exercise behavior of subjects over time (T1, T2, and T3) are provided in Table 4.5. Of 196 subjects at T1, the average weight was 58.7 kg (SD: 8.72 kg; range: 38.8-88.0 kg), height was 157.4 cm (SD: 5.49cm; range: 142-172cm), and body mass index (BMI) was 23.7 % (SD: 3.53%; range 17.2-36.6%) which was within a recommended normal BMI (18.5-24.9). Most (67.9%, n=133) had a normal BMI and 28.6% (n=56) had a BMI of 25 or greater which is considered overweight (n=48) or obese (n=8). The average body fat composition from bioelectrical impedance analysis (BIA) was 31.4% (SD: 7.38%; range 18-56%) which represented a fair condition for this sample of women given their mean age 47.6 ± 9.91 (age range : condition- 45-49 y: excellent-24.3 %-27.2%; good-27.3 %-30.8%; fair-30.9 %-34.0%; poor-34.1 % or above).

For the current activity level, 62% reported being able to carry on normal activities but had minor signs or symptoms related to treatment. Overall, 26% (n=51) intended to exercise and 27.7% exercised regularly, but had been doing so for less than six months. Only 11.3% of women exercised at least three times per week for six months. Subjects spent an average of 108 minutes, 7.5 times and 10.8 (fairly light) on ratings of perceived exertion scale (Addy et al.) (score range: 6 to 20) on exercise per week. The 121 exercisers' most commonly used activities at T1 were walking (n=61, 50%), hiking (n=24, 19.7%), calisthenics & folk dance (n=23, 18.9%), chi-gun & Tai-chi (n=18, 14.8%), fast walking (n=11, 9.0%), and cycling (n=10, 8.2%).

The majority (90.8%) of women felt good during exercise and 89.8% exercised for health reason. However, only 36.7% (n=72) had been exercising regularly, and 51.8% were interested in an exercise program provided by the hospital. However, only 16.3% (n=32) reported that they received exercise counseling through health professional or exercise experts. Those who were not interested in participating in an exercise program in hospital preferred to receive an exercise program at home, exercise on their own or receive exercise instruction from written materials, videotape, audiotape or internet.

None of demographic variables (except for age and education) and the medical variables assessed (types of breast cancer cells, stages, types of adjuvant treatment, types of surgery, and treatment days) were significantly related to exercise frequency. The correlation matrix (Table 4.6) revealed only small correlations between each of the predictor variables and exercise frequency (r= - .05~ .28), which supports the conceptualization of these variables as independent factors. Collinearity diagnostics confirmed the absence of multicollinearity among those predictors and exercise frequency. The strongest association among 10 variables and exercise frequency was the relationship between barrier and exercise self-efficacy (r= .28). The strongest correlates of exercise self-efficacy were exercise barriers (r= - .44), followed by social support for exercise (r= .39). The variables most strongly related to exercise outcome expectancy were social support for exercise (r= .38), exercise self-efficacy (r= .38) and exercise barriers (r= - .37).

Hypothesis Testing

The various relationships hypothesized in the model were investigated with a series of hierarchical multiple regression equations. Although there were five parameters of exercise behaviors which were measured in this study, only exercise frequency was chosen for the purpose of this dissertation. Because age, education, fatigue, physical health, mental health, social support for exercise, and exercise barriers were important predictors of exercise behaviors from the literature, they were entered into the hierarchical multiple regression analyses. However, demographic (except for age and education) and medical variables were not significantly correlated with dependent variables (exercise self-efficacy, exercise outcome expectancy, and exercise frequency) at any of the three stages, and therefore were not entered into these regression analyses.

Time 1 (baseline)

Stage I- outcome variable: exercise self-efficacy.

Hypothesis I: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise and exercise barriers will make a significant contribution to explaining the variance in exercise self-efficacy at baseline.

In predicting exercise self-efficacy scores, two blocks of variables were entered into the analysis. Age, education, exercise history, CRF, physical health, mental health, social support for exercise, and exercise barriers were entered in block 1. Their interaction product terms were entered last through the stepwise regression in block 2. Table 4.7 summarizes the results of the hierarchical multiple regression analysis predicting exercise self-efficacy. The overall model accounted for 31.9 % of the total variance in exercise self-efficacy ($F_{9, 184}$= 9.56, p< .001). Exercise barriers was the largest predictor of exercise self-efficacy, with Beta weight (β) of - .82 (sr^2=0.054, $F_{1, 184}$=14.6, p< .001). Education also had a significant unique contribution to explaining the variance in exercise self-efficacy while holding the other variables constant (β = - .72, sr^2=0.024, $F_{1, 184}$=6.48, p=.012). There was a significant interaction between exercise barriers and education (β = .90, sr^2=0.022, $F_{1, 184}$=5.96, p=.016). The scatter plot in Figure 4.1, details how the generally negative relationship between exercise barriers and exercise self-efficacy actually depends on education level. The lower the level of education the stronger the negative association between exercise barriers and exercise self-efficacy is. The lower the levels of exercise barrier women are, the higher the level of exercise self-efficacy.

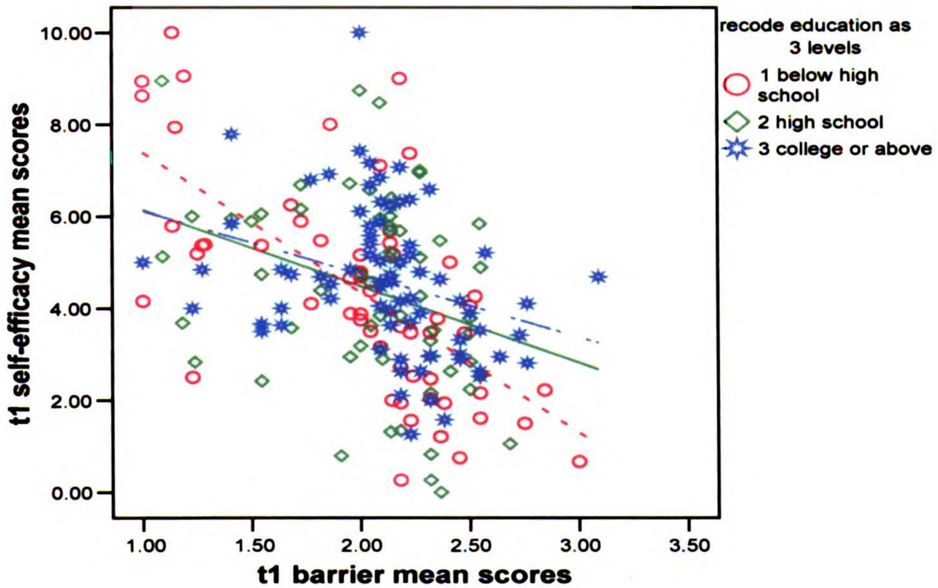


Figure 4.1. The relationship between exercise barriers and exercise self-efficacy depends on education level. Education level categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

In addition, social support for exercise (β = .23, sr^2=0.043, $F_{1,184}$=11.65, p=.001) and age (β = -.14, sr^2=0.015, $F_{1,184}$=4.17, p=.043) also made a significant unique contribution to explaining the variance in exercise self-efficacy while holding the other variables constant. Subjects who perceived higher level of social support and had less education tended to report higher level of exercise self-efficacy. However, exercise history, CRF, perceived health status were not significant predictors of exercise self-efficacy in the regression analysis.

Stage II outcome variable: exercise outcome expectancy.

Hypothesis II: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers and exercise self-efficacy will make a significant contribution to explaining the variance in exercise outcome expectancy at baseline.

In predicting exercise outcome expectancy, two blocks of variables were entered into the analysis. Age, education, exercise history, CRF, physical health, mental health, social support for exercise, exercise barriers, and exercise self-efficacy were entered first in block 1. Their interaction product terms were entered last through the stepwise regression in block 2. The results of the multiple regression analysis in which exercise outcome expectancy was regressed on the predictors are summarized in Table 4.8. The overall model accounted for 32.2% of the total variance in exercise outcome expectancy ($F_{13,\,180}$= 6.58, $p < .001$). Physical health (β=2.10, sr^2=0.048, $F_{1,\,180}$ =12.46, $p < .001$) was the largest predictor of exercise outcome expectancy. Age (β=1.26, sr^2= .036 ,

$F_{1,180}$= 9.64 , p= .002), education (β=1.16, sr^2= .032 , $F_{1,180}$= 8.47 ,p= .004), social support for exercise (β= .94, sr^2= 0.038, $F_{1,180}$= 9.98, p= .002), and exercise self-efficacy (β= .87, sr^2= .022, $F_{1,180}$= 6.03 ,p= .015) also showed significant unique contributions to explaining the variance in exercise outcome expectancy while holding the other variables constant. However, the beta weights for exercise history, CRF, mental health and exercise barriers were not statistically significant in the regression analysis.

In addition, there were four significant interactions related to four independent variables: 1) between social support for exercise and exercise barriers ($F_{1,180}$= 6.16, sr^2=0.023, p=.014), 2) between age and physical health ($F_{1,180}$=10.14, sr^2=0.038, p=.002), 3) between education and physical health ($F_{1,180}$= 6.94, sr^2=0.026, p=.009), and 4) between physical health and exercise self-efficacy ($F_{1,180}$= 4.24, sr^2=0.016, p=.041). Figure 4.2 shows how the generally positive relationship between social support for exercise and exercise outcome expectancy actually depends on the level of exercise barrier. The lower the perceived exercise barriers the stronger the positive association between social support for exercise and exercise outcome expectancy. The stronger the perceived social support for exercise, the more positive the exercise outcome expectancy.

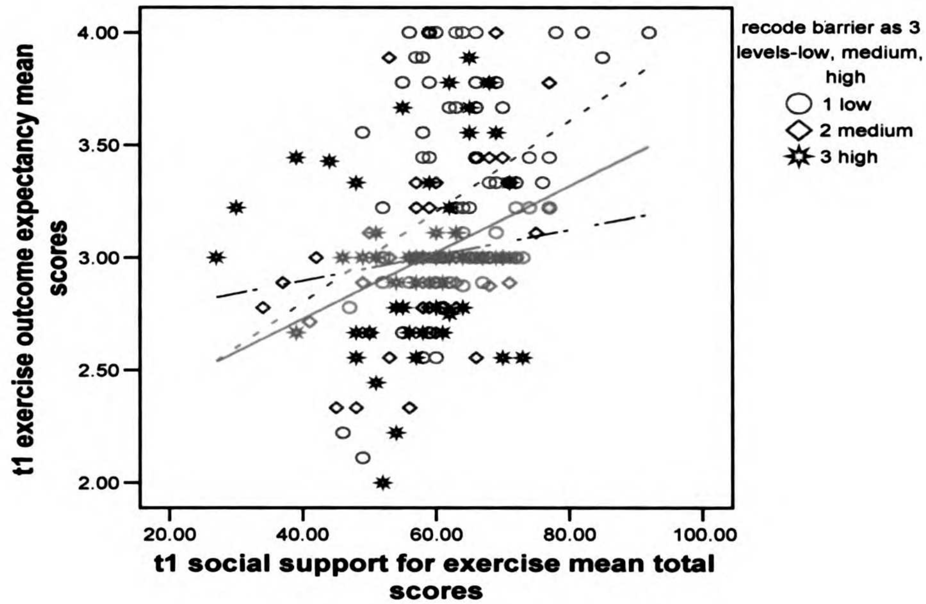


Figure 4.2 The relationship between social support for exercise and exercise outcome expectancy depends on the level of exercise barrier. Exercise barrier categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

Figure 4.3 details how the relationship between physical health and exercise outcome expectancy actually depends on age. The positive association between physical health and exercise outcome expectancy holds true for women from 23 to 55 years old (pre- and perimenopausal). The younger the women are the stronger the positive association between physical health and exercise outcome expectancy. The better the physical health women have the more positive their outcome expectancy. However, the association between physical health and exercise outcome expectancy is negative for women from 56 to 74 years old (postmenopausal).

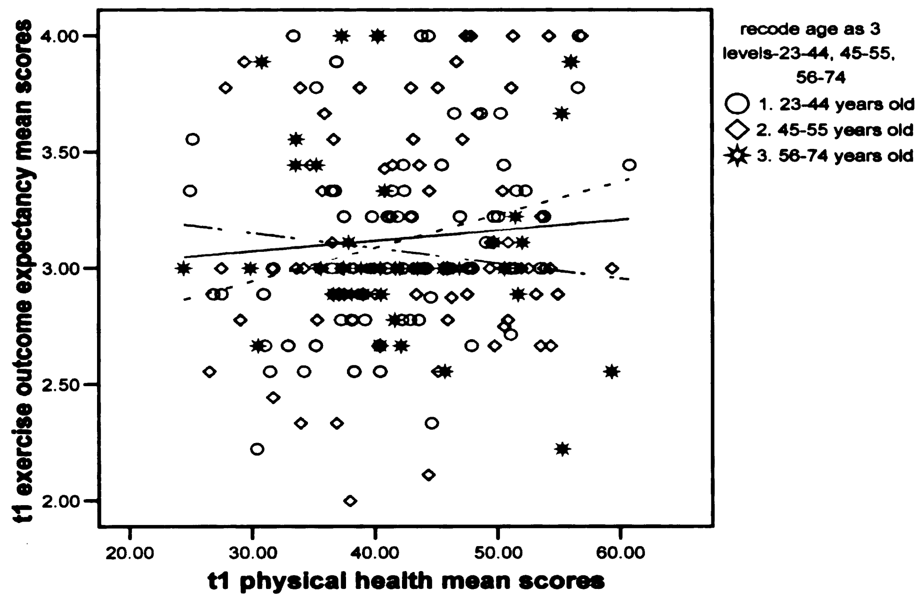


Figure 4.3. The relationship between physical health and exercise outcome expectancy depends on age. Age categorizes as three levels: 23-44 years old (a regular dotted line), 45-55 (a straight line), 56-74 (an irregular dotted line).

Figure 4.4 shows how the generally positive relationships between physical health and exercise outcome expectancy actually depends on education level. The positive association between physical health and exercise outcome expectancy holds true for subjects with a high school education or lower. The lower the level of education, the stronger the positive association between physical health and exercise outcome expectancy. The better the physical health, the more positive the exercise outcome expectancy. However, for those with a college education or above, there is no relationship between physical health and exercise outcome expectancy.

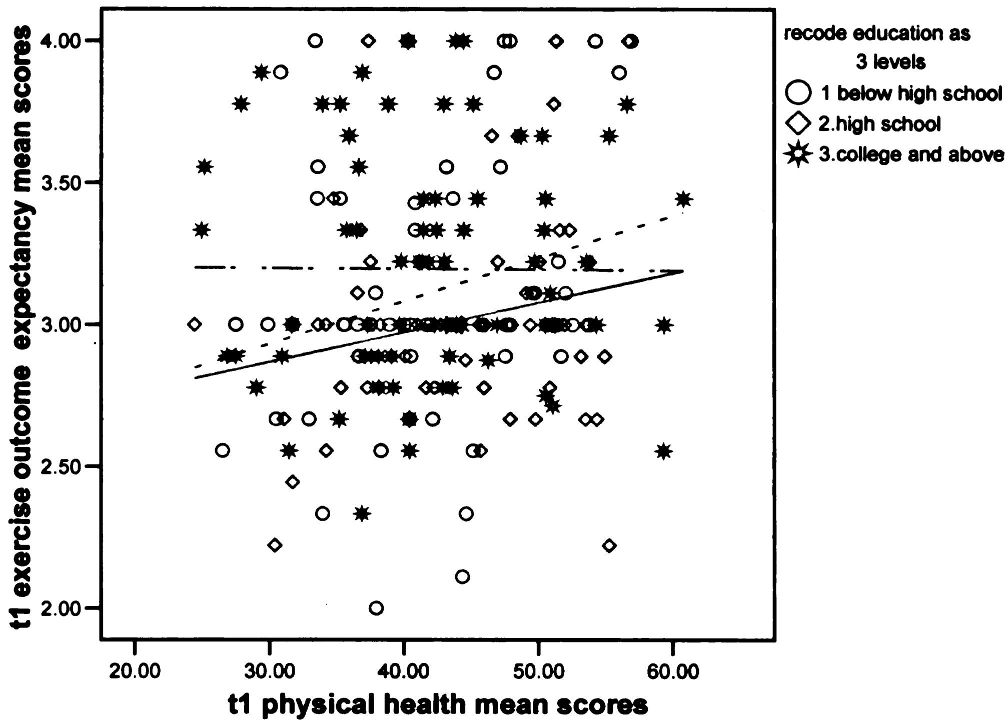


Figure 4.4 The relationship between physical health and exercise outcome expectancy depends on education level. Education level categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

Figure 4.5 details how the generally positive relationships between physical health and exercise outcome expectancy actually depended on the level of exercise self-efficacy. For women perceived medium level of exercise self-efficacy, physical health has more positive impact on exercise outcome expectancy than women with low and high level of exercise self-efficacy. The slopes of the positive relationship between physical health and exercise outcome expectancy for women with low and high level of exercise self-efficacy are similar.

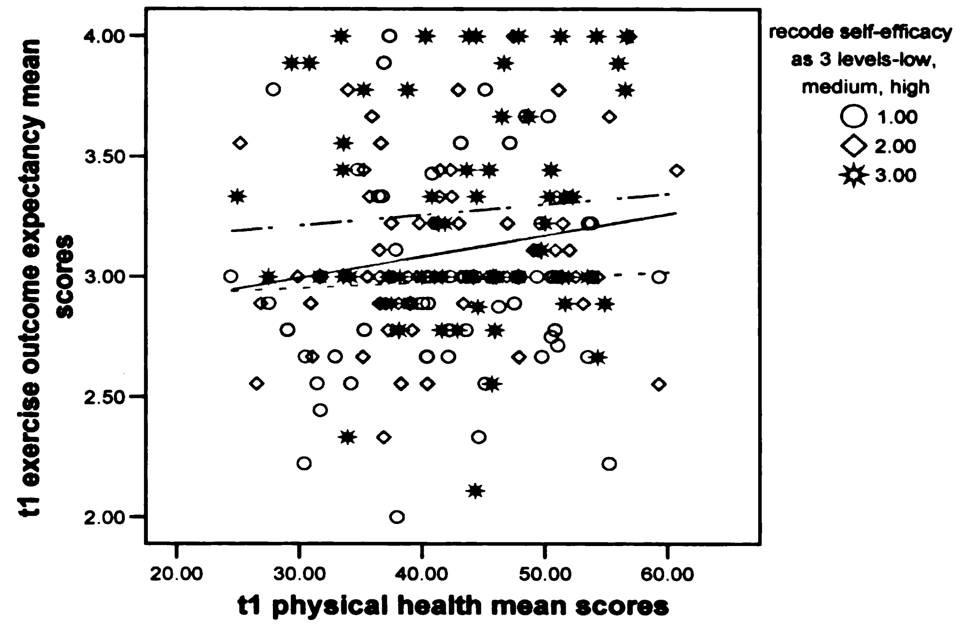


Figure 4.5. The relationship between physical health and exercise outcome expectancy depends on the level of exercise self-efficacy. Level of self-efficacy categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

Stage III outcome variable: exercise frequency.

Hypothesis III: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy will make a significant contribution to explaining the variance in exercise behavior at baseline.

In predicting exercise frequency scores, two blocks of variables were entered into the analysis. Age, education, exercise history, CRF, physical health, mental health, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy were entered in block 1. Their interaction product terms were entered last through the stepwise regression in block 2. Table 4.9 summarizes the results of the hierarchical multiple regression analysis predicting exercise frequency. The overall model accounted for 29% of the variance in exercise frequency ($F_{12, 181}$= 6.148, p< .001). Exercise self-efficacy was the largest unique predictor of exercise frequency, with Beta weight (β) of .37 (p< .001) and explained approximately 7.3% of the total variance in exercise frequency, holding the other independent variables constant ($F_{1,181}$=18.766, sr^2= .073, p<.001). Age (β = .72, sr^2= .026, $F_{1,181}$=6.61, p= .011), education(β = .74, sr^2= .016, $F_{1,181}$=3.992, p= .047), and exercise history (β = .62, sr^2= .046, $F_{1,181}$=11.731, p= .001) also showed significant unique contributions to explaining the variance in exercise frequency at baseline. Controlling for all of the variables, there were two significant interactions: exercise history and exercise self-efficacy ($F_{1,181}$= 12.21, sr^2= .048, p= .001), and age and education ($F_{1,181}$= 4.301, sr^2= .017, p= .039). The scatter plot, shown in Figure 4.6, shows that the association between exercise self-efficacy and exercise frequency actually depends on the exercise history. For those with no exercise history, the association between exercise self-efficacy and exercise frequency is positive. For those subjects with exercise history, there is no association between exercise self-efficacy and exercise frequency.

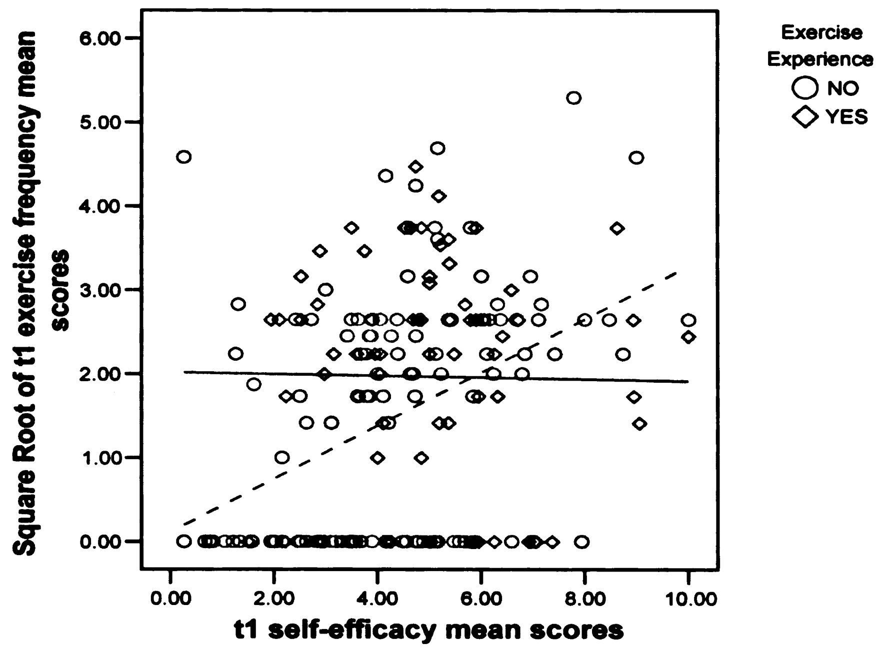


Figure 4.6. The association between exercise self-efficacy and exercise frequency depends on exercise history. Exercise history categorizes as no exercise history (a regular dotted line) and having exercise history (a straight line).

Figure 4.7 shows that the association between age and exercise frequency actually depends on education level. The positive association between age and exercise frequency holds true for women educated less than high school or college above. The lower the level of education the stronger the positive association between age and exercise frequency is. The older the women are the more the increase in exercise frequency. However, the association between age and exercise frequency is not significant for those women with a high school education.

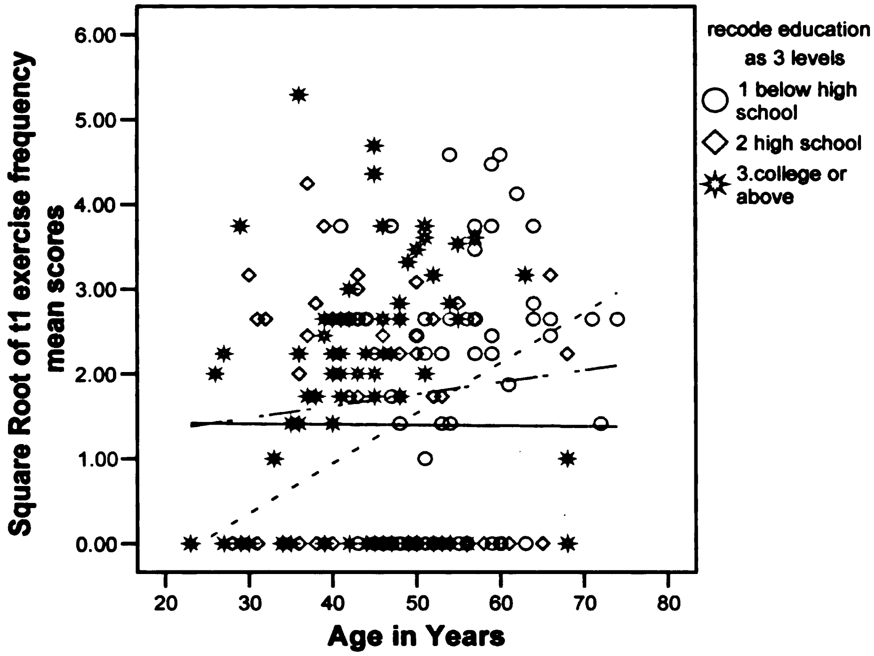


Figure 4.7.The association between age and exercise frequency depends on education level. Education level categorizes as below high school (a regular dotted line), high school (a straight line), college or above (an irregular dotted line) level.

Finally, social support for exercise ($\beta = .26$, $sr^2=0.050$, $F_{1,181}=12.659$, $p< .001$) made a unique contribution to explaining the variance in exercise frequency. The higher the perceived social support for exercise, the more frequent the exercise. CRF, physical health, mental health, exercise barriers and exercise outcome expectancy were not significant predictors of exercise frequency in the regression analysis.

In summary, CRF, exercise history, physical health and mental health were not significant predictors of exercise self-efficacy in the regression analysis. Exercise history, CRF, mental health and exercise barriers were not statistically significant predictors of exercise outcome expectancy. CRF, physical health, mental health, exercise barriers and exercise outcome expectancy were not significant predictors of exercise frequency in this study. Age, education and social support for exercise had direct effects on all three dependent variables. Exercise history had a direct effect on exercise frequency. Exercise barriers had a direct effect on exercise self-efficacy and physical health had a direct effect on exercise outcome expectancy. Fatigue and mental health were not significant predictors of any of these three dependent variables. Exercise barriers had a direct effect on exercise self-efficacy. Finally, exercise self-efficacy had direct effects on exercise outcome expectancy and exercise frequency. Surprisingly, CRF and exercise outcome expectancy did not predict exercise frequency (see Figure 4.8).

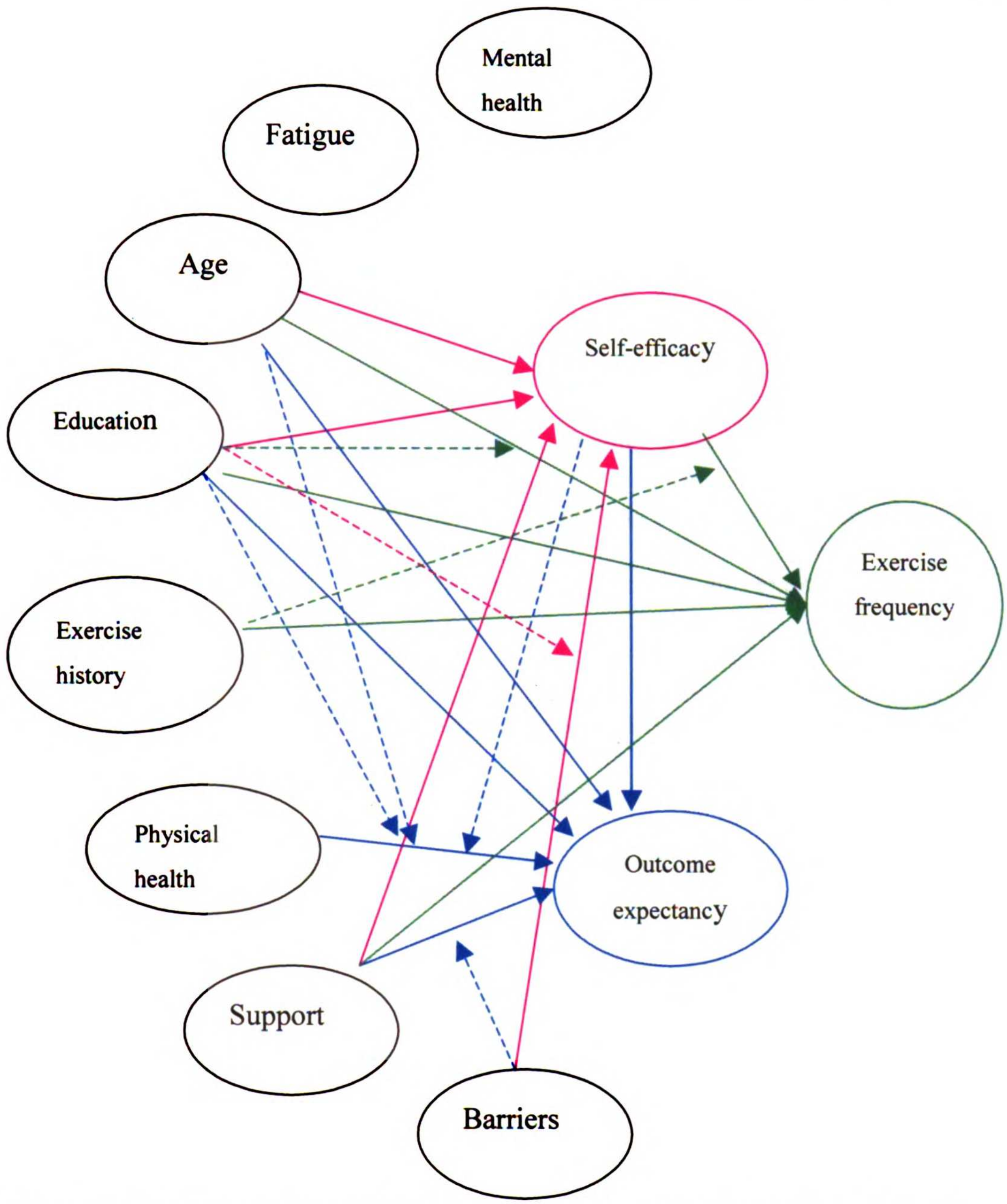


Figure 4.8 Significant direct effects (a straight line→) and interactions (a dotted line---).
Pink lines: to predict dependent variable- exercise self-efficacy
Blue lines: to predict dependent variable- exercise outcome expectancy
Green lines: to predict dependent variable- exercise frequency

<u>Changes over time</u>

Hypothesis IV: Exercise self-efficacy, exercise outcome expectancy, and exercise behavior will significantly increase from T1 to T2, T2 to T3, and T1 to T3.

Hypothesis V: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise and exercise barriers at baseline will make a significant contribution to explaining the variance in exercise self-efficacy over time.

In order to examine whether exercise self-efficacy, exercise outcome expectancy, or exercise frequency changed over time, a series of linear mixed model (LMM) analyses were conducted with time as the repeated factor. As can be seen in Table 4.10, only exercise outcome expectancy, and exercise frequency changed significantly over time.

LMM analyses indicated that there were similar values for exercise self-efficacy over time (Estimated marginal means ± SE: T1:4.46± .14; T2:4.70± .16; T3:4.65± .16). In this sample, there was a small increase between T1 and T2 and a decline at T3 to a level above baseline (T1) assessment. However, the overall change of exercise self-efficacy was not significant over the 6-month period (df=2; F=1.31; p= .283). Therefore, hypothesis V could not be tested.

Hypothesis VI: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers and exercise self-efficacy at baseline will make a significant contribution to explaining the variance in exercise outcome expectancy over time.

Similar LMM analyses conducted on exercise outcome expectancy revealed that there was significant change over time (p= .038). According to the Akaike's

Information Criteria (AIC: 571.9), the unstructured covariance matrix (UN) was a better estimate of the actual covariance structures than compound symmetry (CS). The estimated marginal mean of exercise outcome expectancy for Time 1-2-3 were 3.12 ± .03, 3.04 ± .03, and 3.03 ± .03, respectively. The pairwise comparison tests on the three time points revealed that there was a significant difference between T1 and T3 (p=.016) (T1vs.T2: p=.024; T2 vs.T3: p=.604; criteria α=.05/3= .017) (Table 4.10).

In order to explain how independent variables measured at baseline predicted the significant change in exercise outcome expectancy from Time1 to Time 3, a hierarchical multiple regression was performed. Exercise outcome expectancy at Time 3 was the dependent variable. Exercise outcome expectancy at Time 1 was entered first in its own block. The subsequent independent variables were conceptually predicting the change in exercise outcome expectancy from Time 1 to Time 3. Baseline age, education, CRF, exercise history, physical health, mental health, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy were entered in block 2. Their interaction product terms were entered last through stepwise regression in block 3. The overall model accounted for 20.8% of the total variance in the change exercise outcome expectancy ($F_{11, 176}$ =4.194, $p< .001$) (Table 4.11, Figure 4.10). Exercise outcome expectancy at Time 1 accounted for 13.1% of the variance in exercise outcome expectancy at Time 3 ($F_{1, 186}$ =28.12, $p< .001$). The nine independent variables and one significant interaction explained 8% of the variance in the change exercise outcome expectancy. Social support for exercise was the strongest unique predictor of the increased exercise outcome expectancy from Time 1 to Time 3 (β= .92, sr^2=.023, $F_{1, 176}$ = 5.14, p=.025). Physical health (β=1.07, sr^2= .020, $F_{1, 176}$ = 4.52, p= .035) also showed a significant unique contribution to explaining the variance in the increased exercise outcome expectancy while holding the other variables constant.

In addition, there was a significant interaction between physical health and social support for exercise (β = -1.46, sr^2=0.020, $F_{1, 176}$ =4.52, p=.035). Figure 4.9 details how the relationship between physical health and the change in exercise outcome expectancy actually depends on the level of social support for exercise. The positive association between physical health and the increase in exercise outcome expectancy holds true for those perceived low social support scores. However, for those women's social support for exercise scores with medium level or above, there was no significant association between physical health and the change in exercise outcome expectancy.

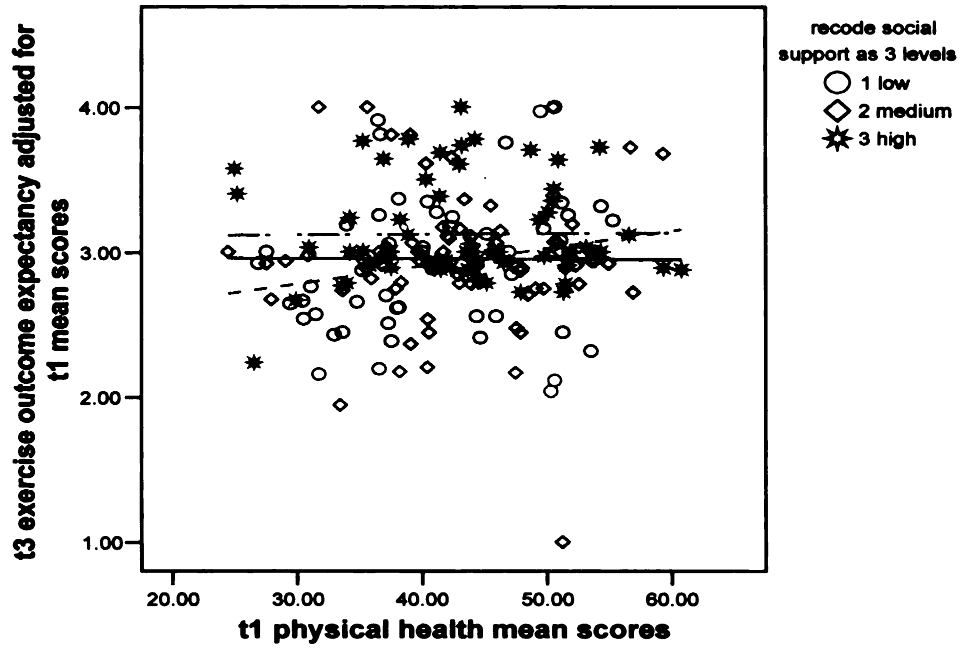


Figure 4.9 The relationship between physical health and the change in exercise outcome expectancy depends on the level of social support for exercise. Level of social support for exercise categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

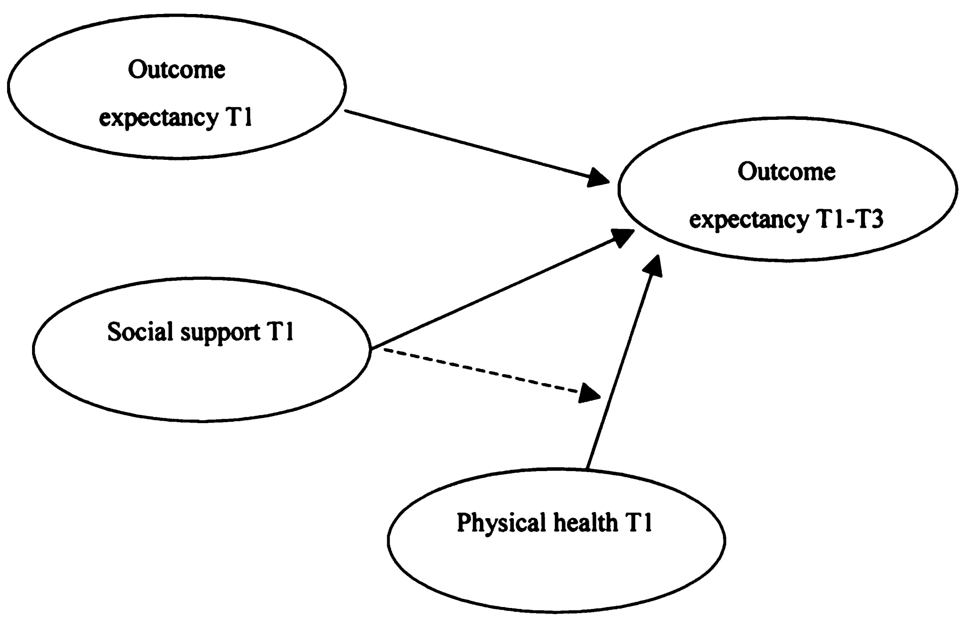


Figure 4.10. Change in exercise outcome expectancy predicted from T1 to T3. Significant direct effects (a straight line→) and interactions (a dotted line---).

Hypothesis VII: Each of the independent variables of age, education, exercise history, CRF, perceived health status, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy at baseline will make a significant contribution to explaining the variance in exercise behavior over time.

LMM analyses conducted on exercise frequency revealed time as a significant effect on the change of exercise frequency (p=.001). According to AIC (2023.4), the unstructured covariance matrix (UN) is better covariance structures than compound symmetry (CS). The estimated marginal mean of exercise frequency for Time 1-2-3 were $1.63 \pm .10$, $2.10 \pm .10$ and $2.00 \pm .10$, respectively. The pairwise comparison test on the three time points revealed that there were two significant mean difference over time: T1 vs. T2 ($p < .001$) and T1 vs. T3 ($p = .004$) (T2 vs. T3: $p = .341$; criteria $\alpha = .05/3 = .017$) (Table 4.10).

In order to explain how independent variables measured at baseline predicted the significant change in exercise frequency from Time1 to Time 2, a hierarchical multiple regression was performed. Exercise frequency at Time 2 was the dependent variable. Exercise frequency at Time 1 was entered first in its own block. The subsequent independent variables were conceptually predicting the change in exercise frequency from Time 1 to Time 2. Baseline age, education, exercise history, CRF, physical health, mental health, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy were entered in block 2. Their interaction product terms were entered last through stepwise regression in block 3. The overall model accounted for 22.6% of the total variance in exercise frequency ($F_{13, 176}$ =3.96, $p< .001$) (Table 4.12, Figure 4.13). Exercise frequency at Time 1 accounted for 11.5% of the variance in exercise frequency at Time 2 ($F_{1, 188}$ =24.51, $p< .001$). The nine independent variables and two significant interactions explained 11% of the variance in the change in exercise frequency. Age (β = -1.17, sr^2=0.025, $F_{1, 178}$ =5.75, p=.018), mental health (β = .88, sr^2=0.029, $F_{1, 178}$ =6.63, p=.011), exercise barriers (β = .562, sr^2=0.018, $F_{1, 178}$ =4.10, p=.044) and two interactions were the only significant predictors of the increase in exercise frequency. These two significant interactions were: between age and social support for exercise (β = 1.50, sr^2=0.026, $F_{1, 177}$ =6.24, p=.016), and between mental health and exercise barriers (β = - .91, sr^2=0.024, $F_{1, 178}$ =5.55, p= .020). Figure 4.11 indicates how the relationship between age and the change in exercise frequency actually depends on the level of social support. The negative association between age and increased in exercise frequency holds true for social support scores in medium level or below. The lower the perceived social support for exercise the stronger the negative association between age and increased in exercise frequency from T1 to T2 becomes. However, the association between age and increased exercise frequency is positive for women with high level of social support for exercise.

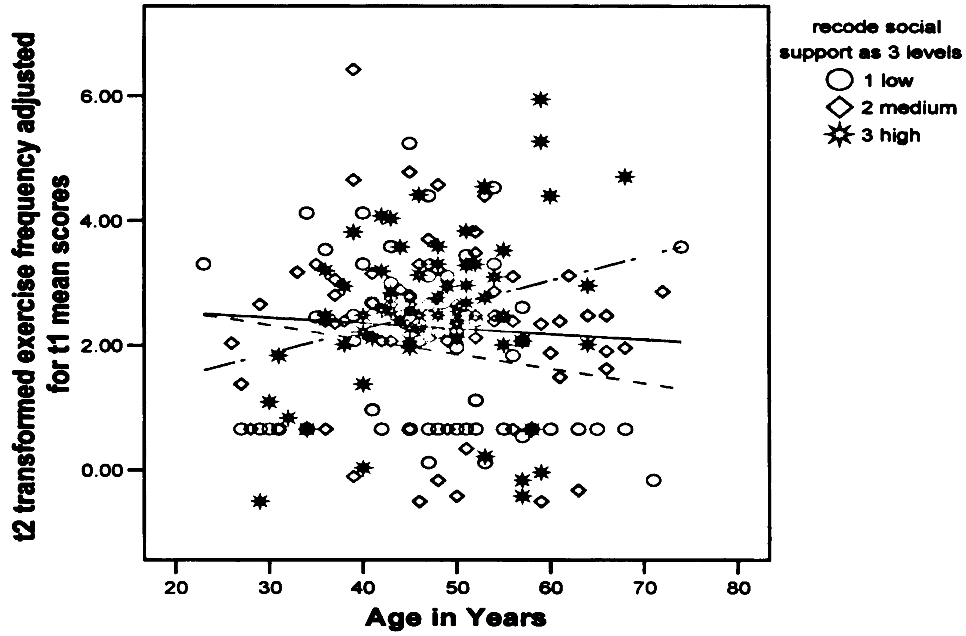


Figure 4.11 The relationship between age and the change in exercise frequency depends on the level of social support for exercise. Level of social support categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

Figure 4.12 indicates how the relationship between mental health and the change in exercise frequency actually depends on the level of exercise barriers. The negative association between mental health and increased in exercise frequency holds true for exercise barrier scores in high. However, the association between mental health and increased exercise frequency was positive for women's exercise barrier scores in low level. For those women's exercise barrier scores in medium level, there is no relationship between mental health and the change in exercise frequency.

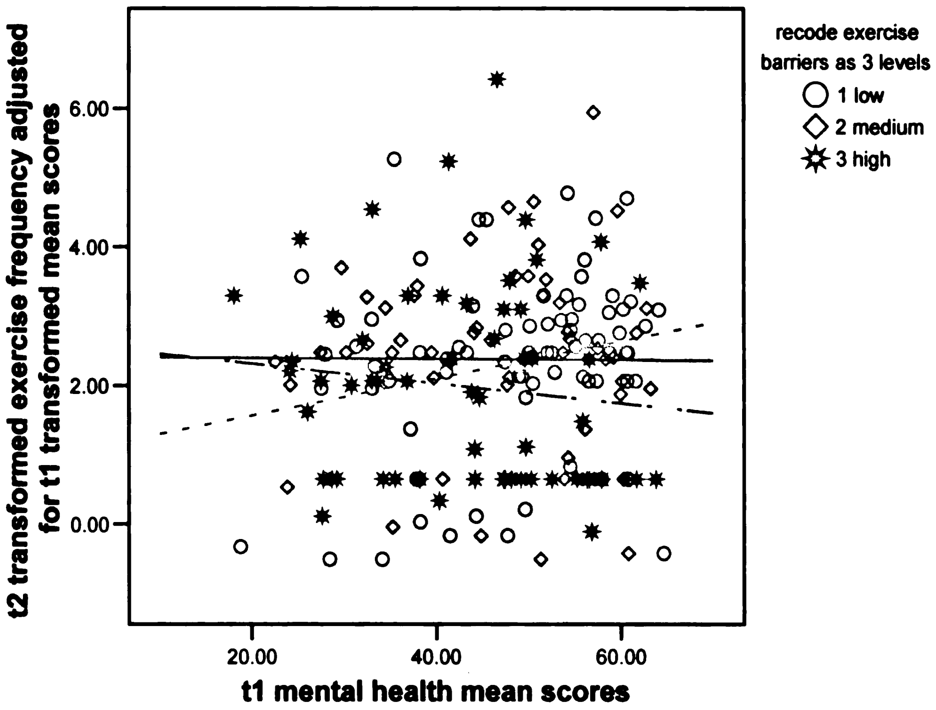


Figure 4.12 The relationship between mental health and the change in exercise frequency depends on the level of exercise barriers. Level of exercise barriers categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

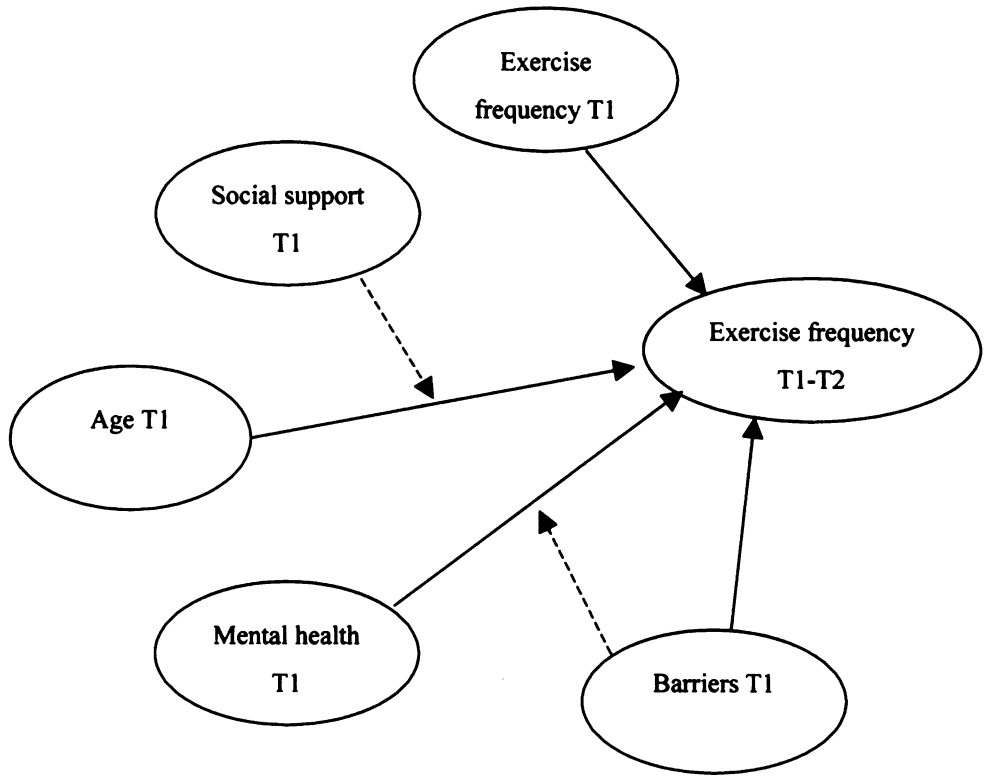


Figure 4.13 Change in exercise frequency predicted from T1 to T2
Significant direct effects (a straight line→) and interactions (a dotted line---).

In order to explain how independent baseline variables predicted the significant change in exercise frequency from Time1 to Time 3, another hierarchical multiple regression was performed. Exercise frequency at Time 3 was the dependent variable. Exercise frequency at Time 1 was entered first in its own block. The subsequent independent variables were conceptually predicting the change in exercise frequency from Time 1 to Time 3. Baseline age, education, exercise history, CRF, physical health, mental health, social support for exercise, exercise barriers, exercise self-efficacy, and exercise outcome expectancy were entered in block 2. Their interaction product terms were entered last through stepwise regression in block 3. The overall model accounted for 19.8% of the total variance in exercise frequency ($F_{13, 175}=3.323$, $p<.001$) (Table 4.13, Figure 4.16). Exercise frequency at Time 1 accounted for 3.7% of the variance in exercise frequency at Time 3 ($F_{1, 187}=7.176$, $p<.001$). The ten independent variables and two significant interactions explained 16.1% of the variance in the change in exercise frequency Time 1 to Time 3.

Social support for exercise was the largest unique predictor of increased exercise frequency from Time 1 to Time 3. ($\beta= -1.11$, $sr^2=.041$, $F_{1, 175}=8.96$, $p=.003$). Age ($\beta = -1.43$, $sr^2=.038$, $F_{1, 174}=8.24$, $p= .005$) also made a significant unique contribution to explaining the variance in increased exercise frequency from Time 1 to Time 3. There were two significant interactions: between age and social support for exercise ($\beta =1.95$, $sr^2=0.047$, $F_{1, 175}=10.20$, $p=.002$), and between CRF and exercise history ($\beta = -.26$, $sr^2=0.033$, $F_{1, 175}=7.32$, $p=.008$). Figure 4.14 details how the relationship between age and the change in exercise frequency actually depends on the level of social support. The higher the perceived social support for exercise the stronger the positive association between age and increased in exercise frequency from T1 to T3. For those with lower perceived social support there was a negative relationship between age and increased exercise frequency. For those with the highest perceived social support, the positive relationship between age and increased exercise frequency is rather steep.

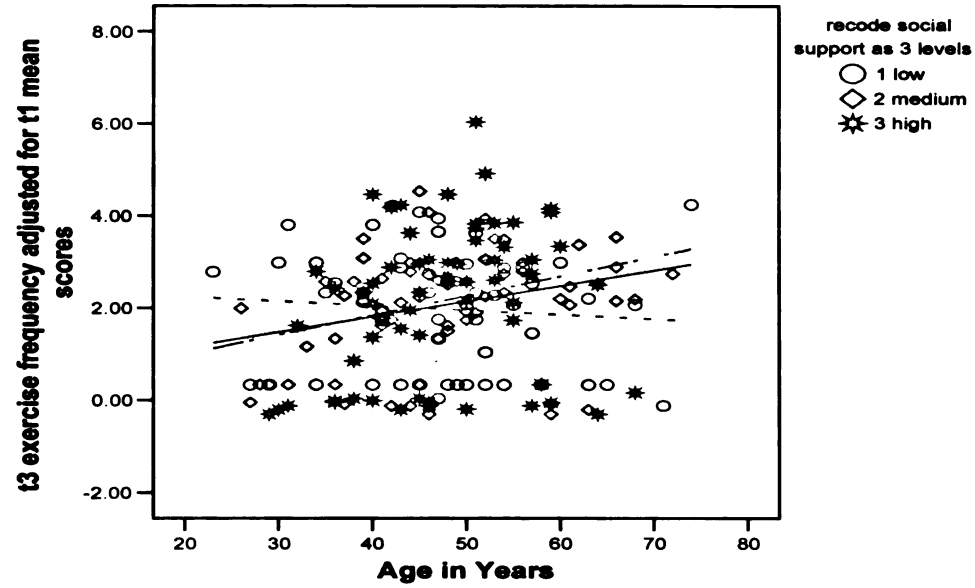


Figure 4.14 The relationship between age and the change in exercise frequency depends on level of social support. Level of social support categorizes as low (a regular dotted line), medium (a straight line), high (an irregular dotted line) level.

Figure 4.15 shows that the association between CRF and the change in exercise frequency depends on exercise history. For those with exercise history, the association between CRF and increased exercise frequency is negative. For those subjects with no exercise history, there is no association between CRF and increased exercise frequency.

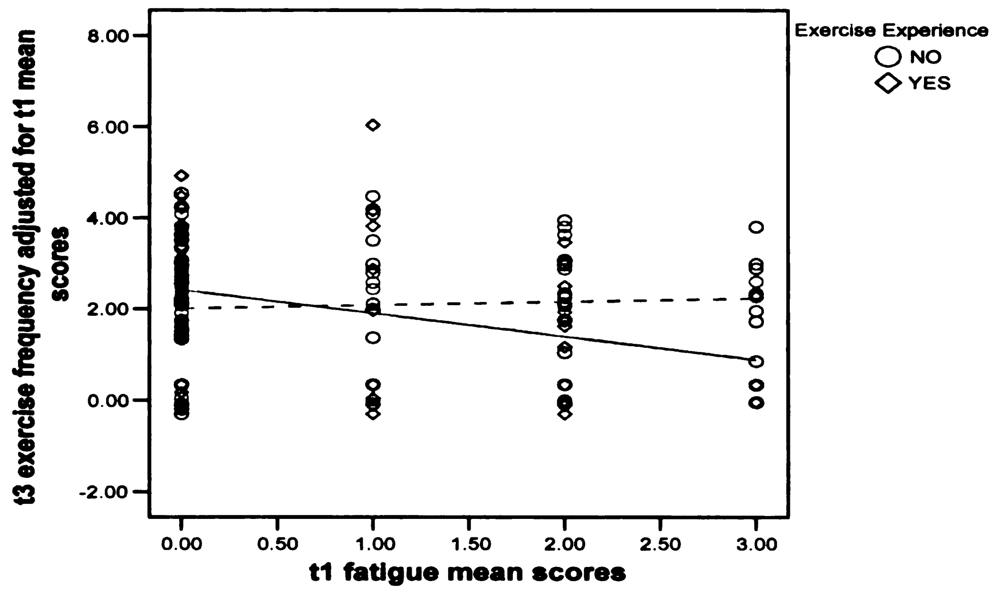


Figure 4.15. The association between CRF and the change in exercise frequency depends on the exercise history. Exercise history categorizes as no exercise history (a regular dotted line) and having exercise history (a straight line).

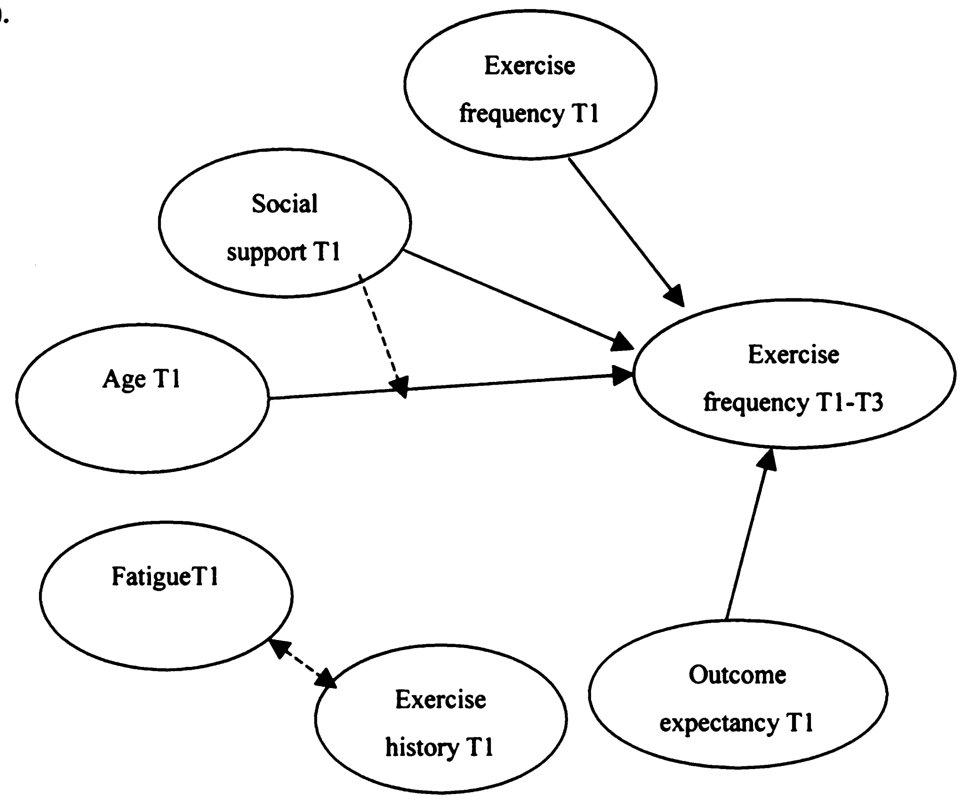


Figure 4.16 Change in exercise frequency predicted from T1 to T3 Significant direct effects (a straight line→) and interactions (a dotted line---).

In addition, exercise outcome expectancy (β = .157, sr^2=0.018, $F_{1,175}$=3.98, p=.048) also made a significant unique contribution to explaining the variance in increased exercise frequency from Time1 to Time 3 while holding the other variables constant. The higher exercise outcome expectancy, the more likely to engage in exercise from Time 1 to Time 3.

In summary, the overall change in exercise self-efficacy was not significant, but exercise outcome expectancy and exercise frequency revealed significant changes over 6 months. Baseline physical health, social support for exercise and the interaction between these two predictors made a significant contribution to explaining the variance in exercise outcome expectancy change from Time 1 to Time 3. Baseline age, mental health, exercise barriers and two interactions (age * social support & mental health * barrier) predicted the significant change exercise frequency from Time 1 to Time 2. Baseline age, social support for exercise, exercise outcome expectancy and two interactions (age * social support & fatigue * history) made a significant contribution to explaining the variance in exercise frequency change over 6 months. Baseline values of these dependent variables were significant predictors of Time 2 and Time 3 values

CHAPTER V

Discussion

The first purpose of this research was to examine the trends in exercise participation over 6 months after adjuvant treatment was completed. Results indicated that women did increase their exercise participation over time, however the overall amount and intensity of exercise participation were below the levels of exercise currently recommended by ACSM (American College of Sports Medicine, 2000). This is the first study in Taiwan to report the complex nature of the factors that influence exercise behavior among breast cancer survivors and demonstrate cross-culture applicability of the instruments. The longitudinal nature of the current study does allow for conclusions to be drawn regarding the causal relations between motivating factors and exercise behavior. The researcher endeavored to investigate efficacy patterns over three times periods, consequently allowing for an examination of the dynamic nature of exercise self-efficacy, exercise outcome expectancy and exercise behaviors. A model was proposed in the present study, and it provided the theoretical foundation. This report includes an examination of relationships among relevant factors including age, education, past exercise history, fatigue, physical health, mental health, social support for exercise, exercise barriers, exercise self-efficacy, exercise outcome expectancy and exercise behavior among Taiwanese breast cancer survivors based on the Social Cognitive Theory.

General overall observations of the examination of baseline relationships includes: 1) of all the hierarchical multiple regressions conducted, no one large significant predictor was observed, but 4-5 smaller significant predictors explained a modest to moderate percentage of the total variance in the three dependent variables; 2) age, education and social support for exercise was a significant predictor for all three dependent variables; 3) exercise self-efficacy was a significant predictor for exercise outcome expectancy and exercise frequency; 4) cancer-related Fatigue (CRF) and mental health were not a significant predictor for any dependent exercise variable; 5) other significant predictors were inconsistent.

General overall observations regarding changes over time includes: 1) modest amount of explained variance for change in exercise outcome expectancy and exercise behaviors, 2) baseline values of these dependent variables were significant predictors of T3 values, 3) age was a significant contribution and the interaction between age and social support for exercise was a significant contribution to exercise frequency change over time, and 4) CRF, only a minor role on its own, had a significant interaction with exercise history as a predictor of change in exercise frequency; 5) other significant predictors were inconsistent.

The findings partially supported the research hypotheses. At baseline, exercise frequency was significantly predicted by age, education, exercise history, social support for exercise and exercise self-efficacy but not by CRF, perceived health status, exercise barriers or exercise outcome expectancy. Age, education, social support for exercise, and exercise barriers were significant predictors of exercise self-efficacy but CRF, exercise history, and perceived health status were not. Age, education, physical health, social support for exercise, and exercise self-efficacy did have a significant direct effect on exercise outcome expectancy. For change over time, the overall change in exercise self-efficacy was not significant, but exercise outcome expectancy and exercise frequency revealed significant changes over 6 months. Baseline physical health, social support for exercise made a significant contribution to explaining the variance in exercise outcome expectancy change from Time 1 to Time 3. Baseline age, mental health, exercise barriers predicted the significant change in exercise frequency from Time 1 to Time 2. Baseline age, social support for exercise, exercise outcome expectancy made a significant contribution to explaining the variance in exercise frequency change over 6 months.

Exercise Behavior

Despite reports in the literature suggesting that regular exercise can have physical and psychosocial beneficial effects in improving quality of life for breast cancer survivors, only 39% of breast cancer survivors in this study indicated they engaged in moderate exercise at least three times per week for 20 to 30 min. However, this percentage is higher than breast cancer survivors (20%~ 32%) in the U.S. (Blanchard et al., 2003; Irwin et al., 2004; Pinto et al., 1998). The difference in the percentage of participation may be due to the participants' definition of "moderate" intensity having included light activities. The exercise diary revealed that those exercisers (T1: n=122; T2: n=147; T3: n=143) engaged in light to moderate intensity for approximately 15 minutes per day over six months [T1: duration-108 minutes (SD:89.05), frequency-7.52 (SD:4.86), intensity- 10.8 (SD:2.13) / per week; T2: duration- 110.81 minutes (SD:82.73), frequency-8.34 (6.50), intensity-11.37(SD:2.46) / per week; T3: duration-118.90 minutes (SD:82.58), frequency- 7.92(5.45), intensity-10.90 (SD:2.17) / per week]. The average time per session and intensity spent among this sample were actually below the recommended guidelines for exercise, although the women exercised more frequently. Pinto et al. (2002) investigated 69 women every three months for one year after they completed treatment for breast cancer. They also found the majority of women either did not exercise at all or exercised below recommended levels.

In the present study, there were significant increases in frequency, duration, and intensity of exercise from T1 to T2 ($p= .001$; $p= .010$; $p< .001$) and T1 to T3 ($p= .009$; $p= .004$; $p=.002$) among these 196 participants. These data showed that although this sample was not exercising at levels that can yield optimal health benefits, they expressed the intention to increase exercise levels. This finding suggests that women respond positively to being physically active as they recover from their cancer treatment.

The most commonly used activities at baseline were walking, hiking, calisthenics, chi-gun, fast walking, cycling and Tai-chi. Walking was the preferred exercise modality performed by this sample which is similar to breast cancer survivors in the U.S. (Blanchard et al., 2003; Irwin et al., 2004; Nelson, 1991). Blanchard and colleagues (2003) analyzed data from 1998 National Health Interview Survey by using a complex stratified, multistage sampling technique in which 335 breast cancer survivors and 6,880 noncancer controls completed the survey (74% response rate). They found that the top 5 activities of both survivors and controls were similar (e.g., walking, yard work, stretching, weight training, and biking).

Exercise Frequency at Baseline

The overall model accounted for 29 % of the total variance in exercise frequency (hypothesis III). The predictive ability of exercise self-efficacy, exercise history, age, education, and social support for exercise offers opportunities for increasing exercise frequency, since these constructs are amenable to intervention. Exercise self-efficacy had the greatest direct effect on exercise frequency at baseline which is consistent with other studies (McAuley, 1992; McAuley et al., 1994; Sallis et al., 1992); (Conn, 1998; DuCharme & Brawley, 1995; Jette et al., 1998; Sternfeld et al., 1999); (McAuley et al., 1999; Nishida, Suzuki, Wang, & Kira, 2003; Plotnikoff et al., 2000; Resnick et al., 2002; Resnick & Spellbring, 2000; Rovniak, 2002). The association between exercise self-efficacy and exercise frequency actually depends on the exercise history. Women with no exercise history and a high sense of self-efficacy were more likely to adopt or engage in exercise on a regular basis than those with lower self-efficacy. Participants with low exercise self-efficacy were more like to be sedentary. Thus, researchers can develop and test specific strategies based on four sources of self-efficacy [a)enactive mastery experience (personal mastery experience); b) vicarious experience (observation of successful or unsuccessful performance of others); c) verbal persuasion (social persuasion); and d) physiological and affective states associated with the specific behavior] for those with lower self-efficacy to engender greater confidence in their ability to engage in regular exercise. Several self-efficacy-based intervention studies resulting in increasing physical activity have been reported (Allen, 1996; Calfas, Sallis, Oldenburg, & French, 1997; Jones, Burckhardt, & Bennett, 2004; McAuley et al., 1994). For those women with an exercise history, their exercise self-efficacy might not influence their exercise participation. Therefore, self-efficacy based intervention may not be effective for these women. This lack of effectiveness is not consistent with Bandura's notion that past mastery experiences lead to future increases in self-efficacy, which further increases the likelihood of future adherence and subsequent mastery experiences (Bandura, 1997).

The baseline data identified that the association between age and exercise frequency actually depended on education levels. The positive association between age and exercise frequency held true for women with an education below high school or at least a college education. For women with an education less than high school, there was a stronger positive relationship between age and exercise frequency as compared to women with a college education or above. For women with less education, the older the women were the more likely the increase in exercise frequency. For women with same age, they had a college education or above were less engage in exercise compared to women with an education less than high school. The reason might be that 33.2% of women in this sample had a full-time or part-time job and those women with a college education or above were more employed than those with less education [19.5% (n=37) vs. 3.7% (n=7)]. Some highly educated women reported a lot of stress and tension from job demands and no time available for exercise. For women who were holding a job and raising a family, it was difficult to set aside time to engage in regular exercise. These women believed they had no leisure time, and if they finally had some time to themselves at the end of day, they would much rather watch television or read to relax and prepare for the next day's demanding schedule.

If an individual believes a behavior is linked to a desirable outcome, the behavior is more likely to be practiced regularly (Bandura, 1997). Interesting, exercise outcome expectancy failed to predict exercise frequency in this study which was inconsistent with other reports (Conn, 1998; Resnick, 2000, 2001; Resnick et al., 2002; Resnick et al., 2000). The lack of significance for this variable might be explained because the majority of women believed regular exercise benefits everyone's health, but is not specific to breast cancer, so their exercise outcome expectancy did not have a strong impact on engaging in exercise. Exercise outcome expectancy did not have a strong impact on the decision related to engaging in exercise. Similarly, exercise outcome expectancy has been found to be a nonsignificant predictor of exercise behavior in young adults and elderly women (Cousins, 1996; Rovniak, 2002).

Exercise Self-Efficacy at Baseline

The overall model accounted for 31.9 % of the total variance in exercise self-efficacy (hypothesis I). Exercise barriers, education, social support for exercise, and age served as significant predictors of exercise self-efficacy. Exercise barrier was the most significant predictor of exercise self-efficacy. The relationship between exercise barriers and exercise self-efficacy depended on the woman's education level. For women with less education, health professionals can assist these women to problem solve their exercise barriers, and gain more confidence in performing exercise. Barriers such as insufficient knowledge, acquisition of incorrect knowledge related to exercise, lack of commitment to exercise and lack of motivation were mentioned frequently by participants. Education can serve to enhance individual's exercise knowledge base and assimilation to enhance exercise self-efficacy. Efforts to educate should be directed at the participants' educational level and readiness to learn. In this study, engagement in both work and family obligations were the major reasons for lack of time among participants. Taking time to exercise was like taking time away from their family responsibilities. The only time many women felt they had " to themselves" was either very early in the morning before their day started or in the evening after children were in bed and chores were completed. Therefore, getting support from family members, having a supportive schedule from workplace, working on time management, and developing a routine are important facilitators of exercise self-efficacy. A few women indicated they had a negative perception of themselves and this acted as a barrier to engaging in exercise. They felt their physical appearance made them feel bad about themselves and limited their engagement in exercise.

Social support for exercise has previously been shown to be positive associated with exercise self-efficacy and results of this study confirm this finding. The higher the level of social support for exercise participants reported, the higher their exercise self-efficacy and the more likely they were to engage in exercise.

These women got social support for exercise from others (family and friends). Family members can assist women to share household chores and family responsibilities to make time available for exercise. Whether occurring within their neighborhood or within a group setting, the support of friends, and exercise professionals offered reinforcement and encouragement for exercise, as well as an opportunity to socialize. Social support for exercise had a significant positive association with exercise self-efficacy as well as exercise frequency. Professional support regarding planning, implementation, and maintenance of an individualized exercise program can help elevate exercise self-efficacy to increase exercise participation. Encouraging exercise with other breast cancer patients may have mental and physical benefits and may also have elevated exercise self-efficacy because they all go through a similar treatment process and disease situation and can gain exercise experience together.

Younger women in this study reported significantly higher levels of exercise self-efficacy than older women which is consistent with previous research (Wilcox & Storandt, 1996). This finding probably reflects some realism on the part of older women; they may not reach the same level of physical fitness as younger women. However, it could also reflect older women's lack of experience with exercise and their stereotypes of old age. Some older women were more likely to yield to social perceptions that exercise is a youthful endeavor that lacks the proper decorum for them.

Outcome Expectancy at Baseline

The overall model accounted for 32.2% of the total variance in exercise outcome expectancy (hypothesis II). Social support for exercise, age, physical health, education and exercise self-efficacy were significant predictors of exercise outcome expectancy. For women with lower exercise barrier, higher social support for exercise scores were associated with better exercise outcome expectancy. Providing a strong social support environment for exercise can positively influence the way women think about exercise outcome. For women with higher exercise barrier, however, social support may not have any impact on changing their exercise outcome expectancy. For pre-menopausal and peri-menopausal women (23 to 55 years old), with a high school education or below, or with exercise self-efficacy scores in medium level or above, physical health status can likewise influence their outcome expectancy, with impaired health being associated with lower outcome expectancy related to exercise. For those post-menopausal women (56-74 years old), however, if they perceived poor physical health, they expected that exercise would provide a good outcome. Older women with high exercise outcome expectancy were more likely to perform exercise (Hellman, 1997). For women with the lowest perceived exercise self-efficacy or with a college education, there was no significant relationship between physical health and exercise outcome expectancy.

Change Over Time

As mentioned in Chapter IV, fatigue and exercise outcome expectancy scores diminished with time, whereas physical health, mental health and social support for exercise scores increased over time. Breast cancer survivors reported less fatigue, better health status, stronger social support and more exercised but expected less positives outcomes from exercise 6 months after they completed adjuvant treatment. Exercise self-efficacy and exercise barrier scores did not change significantly over time.

For women with lower social support for exercise at baseline, the better physical health they were, the greater the increase in exercise outcome expectancy that could be predicted 3 months later. However, for those women with social support for exercise scores in medium level or above at baseline, health status at baseline did not predict an increase in exercise outcome expectancy 3 months later.

For women with low or medium social support for exercise at baseline, the younger they were the greater the increase in exercise frequency 3 months later. In addition, for those women with higher social support for exercise at baseline, the older they were the greater the increase in exercise frequency 3 months later. For women with low exercise barrier at baseline, the better mental health they were the greater the increase in exercise frequency 3 months later. In addition, for those women with higher exercise barrier at baseline, the worse mental health they were the greater the increase in exercise frequency 3 months later.

For women with the higher perceived social support for exercise at baseline, the older they were the greater the increase in exercise frequency 6 months later. However, for those women with the lower perceived social support for exercise at baseline, the younger they were the greater the increase in exercise frequency 6 months later.

For women with an exercise history and less fatigue at baseline, the greater the increase in exercise frequency 6 months later. With regard to positive effects of exercise during treatment, increased energy with decreased fatigue was a consistent effect reported by many participants. However, the exercise should not be too strenuous as this can also increase fatigue. The estimation of individual training levels is essential for creating a safe and effective exercise program. It is important to establish proper exercise dose for exercise programs to reach optimal exercise benefits for breast cancer survivors that consider type, frequency, volume and intensity of exercise, and expected physiological outcome measures. For those women with no exercise history at baseline, their CRF baseline scores did not predict an increase in exercise frequency 6 months later.

As the findings from this study suggest, promoting physical health and providing higher social support for exercise for older women, reducing exercise barriers and promoting mental health, and women with exercise histories and less fatigue in the early stage of rehabilitation should be useful to ensure increasing exercise frequency several months later. Findings from this study suggest it is critical to initiate specific interventions as early as possible.

Research Implications

Although many variables were significant, they accounted for a modest percentage of the variance in exercise behavior. The overall model accounted for 29 % of the variance in exercise frequency (hypothesis III), which is small effect size. Effects size for R^2 can be obtained by using a simple formula $(R^2/(1-R^2)$ from Cohen (1992). Values of .02, .15, and .35 are considered small, medium, and large effect sizes, respectively, in the behavioral science (Cohen, 1992).

Although a comprehensive approach was taken in present study, including all key predictors of exercise behavior based on the SCT and literature, in nearly all models over 70% of the variance remained unexplained. Explained variance was similar to that reported in other studies in community adult samples (De Bourdeaudhuij & Sallis, 2002; Sallis et al., 1986). Such modest relationships still can contribute substantially to the knowledge of processes of influence. The reasons for having such a small effect size for R^2 in current study might be related to exercise frequency in this study only were measured in direct effect of predictors, meaning predictors such as social support for exercise may have an indirect effect on exercise frequency through exercise self-efficacy which could account for more variance in exercise frequency. The use of structural equation modeling in the future could allow for the simultaneous estimation of direct and indirect relationships among those predictors and exercise behavior. In addition, instruments which did not accurately measure the major constructs, or other important factors that this research did not include might attribute to the small effect size.

The appropriateness of some instruments needs to be re-evaluated. Fatigue is considered one of the most common and distressing symptoms of the cancer experience and can persist for months or even years after cancer treatment. However, the incidence of fatigue reported by women in the present study was inconsistent with these findings. It was surprising that only 84 (43%) at T1, 59 (31%) subjects at T2, and 40 (21%) subjects at T3 reported cancer-related fatigue

(CRF) in this study which is a lower incidence than typically reported in the U.S. Although the revised Piper Fatigue Scale (PFS) has its comprehensive measure of multidimensional fatigue from a subjective point of view and possessed good validity and reliability in this study, the questions are worded in such a way that this instrument apply only to those individuals currently experiencing fatigue. The true mean score of the Piper Fatigue score could not be used and an alternative ordinal fatigue score was created to represent levels of CRF. Therefore, it might not be sensitive enough to measure CRF. In the future, the CRF instrument which does not assume the presence of fatigue should be considered, so it can be used with both participants with and without CRF. In addition, the items on the scale might be confounded by patients' reaction to other symptoms and their impact on daily living rather than assessing just the symptom of fatigue. Although the Lee Fatigue Scale reported good validity (face and construct validity) and reliability (internal consistency and test-retest), and the correlation with the PFS was good in the current study (r= .76 and .77), it was used to measure general fatigue intensity and only at Time 2 and Time 3.

A tool that is valid and reliable, easy to administer, and less burdensome for patients is very important for researchers to assess participant's symptoms. Many participants had difficultly answering the Social Provisions Scale for Exercise Scale (SPSE) because of the wording of the questions. The SPSE assesses presence or absence of the provision of social support for exercise. The wording of the SPSE questions (the presence and the absence of the provision at the same time) really confused participants and resulted in difficulty answering, especially for Chinese population who are not used to questions stated negatively. Although the SPSE reflected multiple aspects of social support for exercise, it took more time for participants to complete.

Although exercise self-efficacy scale provided good validity and reliability, it only assessed two resources of exercise self-efficacy (social persuasion and physiological and affective states) but it was not designed to measure other two important resources of exercise self-efficacy (enactive mastery experience and vicarious experience). Therefore, it might only partially measure the concept of exercise self-efficacy. A similar measurement issue may have occurred with the exercise outcome expectancy scale. Exercise outcome expectancy scale focuses on exercise benefits to general health but not specifically to breast cancer. Thus, the majority of women gave answers according to their knowledge and belief, and consequently reported a restricted range of scores (80%-95% answer fell into the range of "agree" and "strongly agree") on exercise outcome expectancy scale resulting in a "ceiling effect" on these results.

Numerous other factors which were not controlled or taken into consideration in this research could have contributed to self-efficacy, exercise outcome expectancy and exercise behavior. For example, exercise support comes from health professionals. Previous studies in the U.S. reported 34% to 50% of breast cancer survivors received a recommendation to exercise from their physician (Demark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000; Segar et al., 1998; Young-McCaughan & Sexton, 1991). One of most powerful documented predictors of exercise participation is the strength of the primary physician's recommendation. Yet, in this study, only 17% to 24% of participants (T1:17%; T2:24%; T3:22%) reported that their physician discussed exercise as part of their rehabilitation. The reasons for this low rate might include the physician's lack of knowledge about the benefits of exercise to breast cancer survivors, lack of skills or comfort in counseling patients on this topic, a perception that benefit will not occur despite the recommendation, and time limitations of physicians. Physicians in Taiwan have an essential role in persuading breast cancer survivors to initiate and sustain exercise. A strong referral from a physician may be an important factor in a Taiwanese breast cancer survivor's decision to engage in exercise. Physicians need to understand the guidelines for exercise for cancer patients and be aware that guidelines exist.

Self-regulation (the personal regulation of goal-directed behavior) and exercise related goals (goal difficulty and goal specificity) are other constructs in SCT found to be significant predictors of moderate physical exercise. Setting goals provides direction, helps determine level of effort to be expended, and fosters persistence. Setting realistic and achievable goals involves a comprehensive assessment such as an exercise testing which can provide baseline information for a reasonable and safe exercise routine. Knowledge of test results can motivate a participant. Repeated testing can provide a sense of achievement and feedback for evaluating and revising goals. Although several previous interventions to increase moderate to vigorous physical exercise among arthritis patients, workers, students, and older women have made use of the those construct (Gyurcsik et al., 2003; Hallam & Petosa, 2004; Muraven, Baumeister, &

Tice, 1999; Petosa, Suminski, & Hortz, 2003; Schneider, 1997; Winters, Petosa, & Charlton, 2003), no reports could be found in the literature that included women with cancer. In addition, self-motivation, personality and exercise-induced feeling state have been found to be important predictors of attendance at exercise (Annesi, 2002a, 2002b; Courneya, Friedenreich, Sela, Quinney, & Rhodes, 2002; Motl, Dishman, Felton, & Pate, 2003; Rhodes, Courneya, & Bobick, 2001). The importance of these factors should be considered in future studies.

Participants complained of several physical symptoms that were not included in the Exercise Barriers Scale, including such things are peripheral neuropathy, lymphedema, premature menopause, body image change, and sexual impairment. One hundred fifteen women in this study reported four common symptoms other than Cancer-related Fatigue at baseline : 1)18% (n=21) had reduced strength and felt like "pins and needles" or numbness in the extremities; 2) 17% (n=19) felt shoulder stiffness and reduced flexibility; 3)17% (n=19) felt aching or throbbing in the arm; 4) 17% (n=19) felt throbbing in the chest. Neural damage may be caused by commonly used chemotherapeutic drugs such as taxol, taxotere, methotrexate (Aziz, 2002; Dellon, Swier, Maloney, Livengood, & Werter, 2004). Arm morbidity and lymphedema can develop after larger numbers of lymph nodes have been dissected, or from post-operative infection and early radiotherapy within the first 18 months following treatment (Edwards, 2000; Keramopoulos, Tsionou, Minaretzis, Michalas, & Aravantinos, 1993; Liljegren & Holmberg, 1997). Many women in this study were upset about having arm problems after adjuvant treatment was completed. They felt frightened because these problems turned into psychological burdens and constantly reminded them of their cancer and the possibility they may never return to their normal life. They reported having little knowledge about arm signs and symptoms.

The special need-orientated and culturally appropriate exercise program may facilities engagement in an exercise program in this Taiwanese population of women. Optimal upper-body function is an essential component of breast cancer rehabilitation to maintain independent living, to allow the individual to engage in everyday activities, return to work, and perform task requiring physical strength and for favorable quality of life (Collins, Nash, Round, & Newman, 2004). Education concerning shoulder exercises should emphasize that shoulder movements should be carried out regularly to prevent restriction of shoulder movement. Specific exercise therapy can be beneficial in improving range of motion, reversing muscle atrophy, activating skeletal muscle, increasing lymphatic drainage and stimulating the immune system (Collins et al., 2004). A traditional Chinese form of exercise, such as Tai Chi, has been practiced in Chinese populations for hundreds of years (Lan, Lai, & Chen, 2002; Li, Hong, & Chan, 2001) and may be particularly appropriate for breast cancer survivors in Taiwan. It can be performed either indoors or outdoors and is a safe, easy modifiable, low-to moderate intensity form of physical exercise with physiological (i.e., cardiorespiratory function, immune capacity, flexibility, balance control, strength, retard bone loss), psychological, and sociological group support benefits optimizing recovery during breast cancer treatment (Chan et al., 2004; Gass, 2003; Wolf, Coogler, & Xu, 1997). The effectiveness of diverse therapeutic exercise programs for breast cancer survivors in Taiwan also need to be evaluated.

There were two situations in this study where women survivors of breast cancer might benefit from regular exercise. First, 102 women (52%) reported premature menopause due to treatment and 78 women (40%) reported being postmenopausal at the beginning of the current study. The majority (62%) of women were treated with Tamoxifen. In younger women, recovery from breast cancer has been achieved using aggressive chemotherapy and radiotherapy that can adversely affect bone tissue or induce premature menopause (Fontanges, Fontana, & Delmas, 2004; Mincey, 2003). Breast cancer patients who receive treatments that reduce estrogen levels, such as aromatase inhibitors, may increase their risk of developing osteoporosis and their risk of fracture (Ravdin, 2004; Waltman et al., 2003). Weight bearing exercise has been found to be beneficial in decreasing bone loss among women (Chan et al., 2004; Galvao & Newton, 2005; Ravdin, 2004; Waltman et al., 2003).

Second, research suggests that many breast cancer survivors experience weight gain during and after adjuvant chemotherapy, and this occurrence places them at risk for cancer recurrence and even death (Aziz, 2002; Blanchard et al., 2003; Djuric et al., 2002; Kroenke, Chen, Rosner, & Holmes, 2005, 2005; Wilmoth, Coleman, Smith, & Davis, 2004). Weight gain affects a woman's self-esteem and body image, and predisposes breast cancer survivors to other morbidities such as diabetes mellitus and cardiovascular disease (Djuric et al., 2002; Schwartz, 2000). At baseline, 68% (n=133) of women had a normal BMI and 29% (n=56) had a BMI of 25 or greater which indicates being overweight (n=48) or obese (n=8). Although LMM analyses indicated that women's BMI remained stable over six months in the current study, a lot of women still worried about weight gain and being out of shape after starting Tamoxifen treatment. It has been documented consistently for the past two decades that 50% to 96% of breast cancer patients receiving adjuvant therapy gained from 5 to 50 lbs (Kumar et al., 2004). Manson and colleague examined the association between BMI and mortality in a cohort of 115,195 U.S. women entering the study in 1976, with follow-up through 1992. These women were 30 to 55 years of age and free of known cardiovascular disease and cancer in 1976. The results showed that the overall mortality risk rose substantially with a BMI greater than 27(Manson et al., 1995). Calle et al. (2003) also found that increased BMI was significantly associated with increased cancer death rates in a sample of 404,576 men and 495,477 women during 16 years of follow-up and the relative risk for women was 1.62 (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003). Participating in exercise regularly has been documented for the prevention of weight gain and decreased obesity(Aziz, 2002; Irwin et al., 2004; Wilmoth et al., 2004).

Limitations and Future Directions

The findings in this study are preliminary, and there are limitations in this study that need to be taken into consideration when interpreting the findings and planning future research. The use of the convenience sampling technique employed here does not provide necessarily accurate estimates of the underlying Taiwanese breast cancer population. Because the sample was largely married, highly educated and middle class with stages 0-IIIA breast cancer, results cannot be generalized to single women, those with less education, low income, or stage IV or metastatic breast cancer. Exercise behavior was obtained from the participants by use of a self-report assessment, which is typically inferior to objective assessments. There may be a bias, with some participants wishing to respond in a socially desirable manner or inflate their amount of exercise. The timing of measurement may have been another limitation. Interviews were conducted 3-4 weeks after patients had been discharged from the hospital, three month and six month after the Time 1 interview. Although these times have been recognized as the convenient and optimal time to measure exercise behavior, the best time to assess exercise behavior after discharge still needs further examined.

Future studies should incorporate randomized controlled trial designs in order to test specific factors that can influence exercise behavior. In addition, this study needs to be replicated with a more diverse sample and with longer follow up. Furthermore, there is a need for objective measures of exercise to prevent self-report bias. Although there was a very low attrition rate (2.6%) observed in this study, 153 questions for each interview was a burden on breast cancer survivors. To improve quality of responses in the future work, consideration should be given to limiting the amount of data collected in repeated interviews. In addition, future studies should incorporate randomized controlled trial designs among Taiwanese breast cancer survivors in order to be able to assess the physiological, psychological, and social beneficial effects.

There is a great need to make exercise programs more widely available and to integrate them into the secondary prevention of rehabilitation care. Breast cancer survivors in this study were interested in receiving exercise-counseling and exercise programming services as part of their supportive care. They had a strong preference to be counseled by someone who understands both exercise programs, the cancer experience and a formal affiliation with a cancer center. Therefore, health professionals should continue to evaluate women's unique needs after they complete treatment. They also need to be aware of these symptoms and their importance to breast cancer survivors in order to provide effective care, necessary referrals to other health experts and candid advice about what to expect during recovery from breast cancer. Face to face counseling is the preferred method of delivery and was recommended by women in the current study.

Consistent, accurate, systematic, and clear exercise knowledge and advice across health care professionals should be a goal to avoid patient confusion (Karki, Simonen, Malkia, & Selfe, 2004). Sometimes during follow-up appointments, women were given conflicting advise regarding exercise and this resulted in uncertainty as to what level of exercise to do. Multidisciplinary care protocols created gaps in the continuity of information, when mutual understanding and cooperation between different health professionals was insufficient. To improve the problem, it is recommended that standard follow-up guidelines should be developed and Department of Health, Executive Yuan in Taiwan should provide training courses to health professionals to enhance their understanding and communication.

Small-group exercise sessions may have, as an unintended effect, created a support group-like environment for these cancer survivors. In this study, approximately fifty percent of participants (T1:52%; T2:44%; T3:45%) reported that they planed to participant in exercise program if offered by the hospital. They thought an exercise program could unite people who had faced similar serious health challenges and, in a carefully monitored and encouraging setting, allow them to exercise together. However, on-site exercise programs (with associated scheduling and transportation costs) were not attractive to some participants who would not attend group exercise classes or did not prefer this format. In keeping with SCT, researchers need to consider environmental factors and less expensive and less demanding programs, such as exercising in their communities and neighborhoods.

Conclusion

As more patients are surviving cancer diagnosis and treatment, the quality of a person's life may be as important as the length of life. For this reason, the effort to improve quality of life is a main focus of breast cancer rehabilitation. Exercise can provide physical, functional, psychological, and emotional benefits to improve overall QOL in breast cancer survivors. Health professionals must be knowledgeable of the current evidence supporting regular exercise and the role of exercise when planning health education and promotion interventions. They should also seek to determine the meaning of exercise for breast cancer survivors and understand the common barriers and facilitators associated with exercise initiation and adherence. Health professionals' knowledge should be used to counsel survivors on benefits of regular exercise, encourage participation, refer to appropriate exercise program, and monitor exercise levels and health status changes associated with exercise.

In conclusion, numerous variables and theories have been studied in attempts to explain why people participate or do not participate in exercise behaviors. Because participation in exercise behaviors is a complex phenomenon, a set of variables and their relationships has been proposed to explain participation in exercise behaviors more fully. Preliminary data from the present study indicates that there is abundant information related to exercise behavior among the breast cancer survivors in Taiwan. The findings from this study contribute to the literature on psychosocial and exercise aspects of breast cancer survivors, including understanding which women are more likely to participate exercise, what they see as major barriers for engaging in exercise, and demonstrating cross-culture applicability of the instruments used in breast cancer survivors in Taiwan.

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APPENDIX-A

Recruitment letter

January 2, 2003

Dear Breast Cancer Survivors,

We need your help in conveying the needs of breast cancer survivors. As you know, breast cancer is the second leading cancer in Taiwan and the incidence rate of breast cancer has increased every year. Cancer-related fatigue (CRF) has been recognized as an almost universal side effect during and after breast cancer treatment. CRF differs from the fatigue healthy people experience and persists despite adequate rest and sleep. CRF can limit usual work and social roles and consequently may negatively impact economic, physical, and psychological well-being.

Health care professionals commonly recommend rest for CRF. However, inappropriate or prolonged rest may result in deconditioning, impair quality of life and increase CRF. Exercise is one intervention suggested to prevent or decrease CRF. Exercise improves functional capacity, overall quality of life and self-concept, increases muscle strength and interpersonal support, and decreases fatigue and feelings of depression. The benefits of exercise are best realized through regular participation. In Taiwan, unfortunately, exercise is not popular and information regarding the determinants of exercise for breast cancer survivors is not available. Therefore, we feel that it is very important to identify determinants of exercise during breast cancer rehabilitation to assist researchers to develop culturally sensitive exercise programs for breast cancer survivors.

The researchers in the UCSF School of Nursing are coordinating this study funded by Department of Defense of US Army. Your willingness to participate in this study will greatly assist us in meeting our goal. You will participate in an interview in which one of researchers will meet with you individually. During this interview, you will be asked questions about health status, fatigue and exercise practices. This interview will take about 30-45 minutes of your time. This interview will be arranged with you at a time and place that is convenient for you. There are two additional mail surveys at three and six months after the first in person interview. You will receive a gift for your time after completing the study.

If you are interested in participating in this study, please contact your nurse or contact Hsin-Tien Hsu at the research office (02) 2341-0482. We will contact you and arrange for your participation.

Thank you for your interest. We look forward to working with you.

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APPENDIX-B

Informed consent

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO
CONSENT TO BE A RESEARCH SUBJECT

Determinants of exercise for breast cancer survivors with fatigue in Taiwan

1. PURPOSE AND BACKGROUND

You are being asked to participate in this study because breast cancer is the second leading cancer in Taiwanese women and Cancer-Related Fatigue (CRF) has been recognized as one of the distressing side effects after breast cancer treatment. Exercise is one of the few interventions suggested to alleviate CRF. Unfortunately, however, very few adults in Taiwan report engaging in exercise. No information is available concerning the determinants of exercise for breast cancer survivors in Taiwan. Hsin-Tien Hsu, R.N., MSN and Marylin Dodd, R.N.,Ph.D. from the University of California at San Francisco, School of Nursing, and Dr. Chiun-Sheng Huang, National Taiwan University Hospital, Department of Surgery are coordinating a study funded by Department of Defense of US Army to identify major factors influencing exercise among breast cancer survivors to assist both researchers and health care providers in helping breast cancer survivors increase their exercise involvement. Participation in this study is not a standard part of cancer care, and choosing not to participate will have no effect on your medical care or on activities in support group.

2. PROCEDURES

If you agree to be in the study, the following will occur:

1. You will be asked to complete questionnaires by Hsin-Tien Hsu regarding your age, employment, experience regarding exercise, health status, and social support. It will take about 30-45 minutes to complete the questionnaires. The questionnaire will be completed by interview at the first time follow-up appointment (3~4 weeks after treatment completion) (baseline-Time 1 [T1]), and at three months (Time 2 [T2]) and six months (Time 3[T3]) by mail survey.
2. The procedures at T1 will be done in a place of your choosing, where you feel comfortable and scheduled at your convenience.
3. Hsin-Tien Hsu will check your clinic chart to gather information about your treatments and routine laboratory tests.

3. RISKS/DISCOMFORTS

1. You do not have to answer any question(s) that may make you feel uncomfortable, and you can stop the interview at any time.

2. If you feel too tired or ill to complete the interview, the interview can be rescheduled.

3. Confidentiality: Participation in research can involve loss of privacy. Information about you will be handled as confidentially as possible. All records in this study will be coded and will be kept in a locked cabinet. Only the investigators and Department of Defense of the U.S. Army will have access to your records and review the study results. No individual identities will be used in any reports or publications resulting from this study.

4. BENEFITS

There may or may not be direct benefit to you from participating in this study. However, the information that you provide may help health professionals better understand the factors influencing exercise for breast cancer survivors and may benefit other patients with breast cancer in Taiwan in the future.

5. ALTERNATIVES

You may refuse to participate in this study.

6. COST

There will be no costs to you as a result of taking part in this study.

7. REIMBURSENT

You will receive gifts for reimbursement in this study

8. QUESTIONS

The study has been explained to you by Hsin-Tien Hsu, or one of her associates (____________________) and your questions have been answered to your satisfaction. If you have any comments or concerns about participation in this study, you should first talk with the investigators, Hsin-Tien Hsu, at (02) 2341-0482, or Marylin Dodd, at 002-1-(415) 476-4320. If for some reason you do not wish to do this, you may contact the professors, Dr. Chiun-Sheng Huang, between 8:00 and 5:00, Monday through Friday, by calling (02) 23123456 ext 5683 or Dr. Shiow-Li Hwang (02) 23123456 ext 8429 or by writing: School of Nursing, National Taiwan University, No. 1, Jen Ai Road, Section 1, Taipei 100,. In addition you may contact the Committee on Human Research, which is concerned with the protection of volunteers in research projects. You may reach the committee office between 8:00 and 5:00, Monday through Friday, by calling 002-1-(415) 476-1814, or by writing: Committee on Human Research, Box 0962, University of California, San Francisco/San Francisco, CA 94143.

9. CONSENT

You will be given a copy of this consent form to keep.

PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline to participate in this study, or to withdraw from it at any point without jeopardy to your medical care.

If you agree to participate, you should sign below.

____________________ ____________________________

Date Signature of Study Participant

____________________ ____________________________

Date Signature of Person Obtaining Consent

APPENDIX C

(PIPER) Revised Piper Fatigue Scale

Directions: For each of the following questions, circle the number that best describes the fatigue you are experiencing now. Please make every effort to answer each question to the best of your ability. Thank you very much.

1. How long have you been feeling fatigued? (check one response only)

   a. Minutes _______

   b. Hours_______

   c. Days_______

   d. Weeks_______

   e. Months_______

   f. Other (please describe):_______________________________________

2. To what degree is the fatigue you are feeling now causing you distress?

No distress   A great deal of distress

0 1 2 3 4 5 6 7 8 9 10

3. To what degree is the fatigue you are feeling now interfering with your ability to complete your work or school activities?

None   A great deal

0 1 2 3 4 5 6 7 8 9 10

4. To what degree is the fatigue you are feeling now interfering with your ability to visit or socialize with your friends?

None   A great deal

0 1 2 3 4 5 6 7 8 9 10

5. To what degree is the fatigue you are feeling now interfering with your ability to engage in sexual activity?

None   A great deal

0 1 2 3 4 5 6 7 8 9 10

6. Overall how much is the fatigue, which you are experiencing now, interfering with your ability to engage in the kind of activities you enjoy doing?

None A great deal

0 1 2 3 4 5 6 7 8 9 10

7. How much you describe the degree of intensity or severity of the fatigue which you are experiencing now?

None Severe

0 1 2 3 4 5 6 7 8 9 10

To what degree would you describe the fatigue which you are experiencing now as being:

8. Pleasant Unpleasant

0 1 2 3 4 5 6 7 8 9 10

9. Agreeable Disagreeable

0 1 2 3 4 5 6 7 8 9 10

10. Protective Destructive

0 1 2 3 4 5 6 7 8 9 10

11. Positive Negative

0 1 2 3 4 5 6 7 8 9 10

12. Normal Abnormal

0 1 2 3 4 5 6 7 8 9 10

13. To what degree are you now feeling:

Strong Weak

0 1 2 3 4 5 6 7 8 9 10

14. To what degree are you now feeling:

Awake Sleepy

0 1 2 3 4 5 6 7 8 9 10

15. To what degree are you now feeling:

Lively Listless

0 1 2 3 4 5 6 7 8 9 10

16. To what degree are you now feeling:

Refreshed Tired

0 1 2 3 4 5 6 7 8 9 10

17. To what degree are you now feeling:

Energetic Unenergetic

0 1 2 3 4 5 6 7 8 9 10

18. To what degree are you now feeling:

Patient Impatient

0 1 2 3 4 5 6 7 8 9 10

19. To what degree are you now feeling:

Relaxed Tense

0 1 2 3 4 5 6 7 8 9 10

20. To what degree are you now feeling:

Exhilarated Depressed

0 1 2 3 4 5 6 7 8 9 10

21. To what degree are you now feeling:

Able to concentrate Unable to concentrate

0 1 2 3 4 5 6 7 8 9 10

22. To what degree are you now feeling:

Able to remember Unable to remember

0 1 2 3 4 5 6 7 8 9 10

23. To what degree are you now feeling:

Able to think clearly Unable to think clearly

0 1 2 3 4 5 6 7 8 9 10

24. Overall, what do you believe is most directly contributing to or causing your fatigue?______________________________

25. Overall, the best thing you have found to relieve your fatigue is:

____

26. Is there anything else you would like to add that would describe your fatigue better to us?______________________________

27. Are you experiencing any other symptoms right now?

No

Yes, Please describe______________________________

APPENDIX D

Lee Fatigue Scale-8

We are trying to find out about your level of energy before your sleep. For each of items listed below, <u>circle the number</u> (from 0 to 10) to indicate how you are felling <u>right now</u>. This should take between 1 to 5 minutes of your time. Thank you.

1. not at all tired/ fatigued	0	1	2	3	4	5	6	7	8	9	10	extremely tired/fatigued
2. not at all sleepy	0	1	2	3	4	5	6	7	8	9	10	extremely sleepy
3. not at all exhausted	0	1	2	3	4	5	6	7	8	9	10	extremely exhausted
4. moving my body is no effort at all	0	1	2	3	4	5	6	7	8	9	10	moving my body is a tremendous chore
5. concentrating is no effort at all	0	1	2	3	4	5	6	7	8	9	10	concentrating is a tremendous chore
6. carrying on a conversation is no effort at all	0	1	2	3	4	5	6	7	8	9	10	carrying on a conversation is a tremendous chore
7. I have absolutely no desire to lie down	0	1	2	3	4	5	6	7	8	9	10	I have a tremendous desire to lie down
8. not at all energetic	0	1	2	3	4	5	6	7	8	9	10	extremely energetic

SF-12 HEALTH SURVEY (STANDARD)

Date

Patient ID

INSTRUCTIONS: This questionnaire asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

Please answer every question by marking one circle. If you are unsure about how to answer, please give the best answer you can.

1. In general, would you say your health is:

O Excellent O Very Good O Good O Fair O Poor

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, Limited A Lot	Yes, Limited A Little	No, Not Limited At All
2. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	O	O	O
3. Climbing **several** flights of stairs	O	O	O

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
4. **Accomplished less** than you would like	O	O
5. Were limited in the **kind** of work or other activities	O	O

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
6. **Accomplished less** than you would like	O	O
7. Were limited in the **kind** of work or other activities	O	O

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

ONot at all OA little bit OModerately OQuite a bit OExtremely

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks-

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
9. Have you felt calm and peaceful?	O	O	O	O	O	O
10. Did you have a lot of energy?	O	O	O	O	O	O
11. Have you felt downhearted and blue?	O	O	O	O	O	O

12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

OAll of the time OMost of the time OSome of the time OA Little of the time ONone of the time

APPENDIX F

SOCIAL PROVISION SCALE for EXERCISE

Please respond to the following statements by indicating whether you strongly disagree, disagree, aggress, or strongly agree to each. Place an X in the box which corresponds to your response. "Exercise" is any moderate physical activity that you do in your discretionary time on a regular basis for at least 20 minutes (i.e., walking, swimming, bicycling, sports).

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. There are people I can count on to exercise with me	☐	☐	☐	☐
2. I do not have any close relationships with people who lead an active lifestyle.	☐	☐	☐	☐
3. There is no one I can turn to for guidance with exercise.	☐	☐	☐	☐
4. There are people who depend on me for help with exercise	☐	☐	☐	☐
5. There are people who enjoy the same physical activities that I do.	☐	☐	☐	☐
6. Other people do not think of me as being physically active.	☐	☐	☐	☐
7. I feel personally responsible for helping another person exercise.	☐	☐	☐	☐
8. I am part of a group people who share my attitudes about physical activity.	☐	☐	☐	☐
9. I do not think other people respect my physical skills and abilities.	☐	☐	☐	☐
10. There is no one to take over chores for me so I have time to exercise.	☐	☐	☐	☐
11. I have a strong emotional bond with at least one person who values physical activity.	☐	☐	☐	☐
12. There is someone I can talk to about exercise.	☐	☐	☐	☐
13. There are people who recognize my competence at physical activity.	☐	☐	☐	☐
14. There is no one who shares my interests and concerns about physical activity.	☐	☐	☐	☐
15. There is no one who relies on me for help maintaining an active lifestyle.	☐	☐	☐	☐
16. There is a person I can turn to for advice if I have problems with exercise.	☐	☐	☐	☐
17. I have close relationships that provide me with a sense of well-being.	☐	☐	☐	☐
	☐	☐	☐	☐

18. There is no one who rewards me being active.
19. There is no one I feel comfortable talking with about exercise.
20. There are people who admire my talents and abilities.
21. I am not close to anyone who values physical activity.
22. There is no one who likes to do the same activities I do.
23. There are people I can depend on to help me be active by changing their schedule so we can exercise together.
24. No one needs me to exercise with him or her.

APPENDIX G

BARRIERS TO EXERCISE

Please respond to the following statements by indicating whether you strongly disagree, disagree, agree, or strongly agree to each. Place an X in the box which corresponds to your response. "Exercise" is any moderate physical activity that you do in your discretionary time on a regular basis for at least 20 minutes per session, three times per week in a typical week (i.e., walking, swimming, bicycling, sports).

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. Places to exercise too far away	☐	☐	☐	☐
2. Too embarrassed to exercise	☐	☐	☐	☐
3. Cost too much to exercise	☐	☐	☐	☐
4. Inconvenient facility schedules	☐	☐	☐	☐
5. People in exercise clothes look funny	☐	☐	☐	☐
6. Too few places to exercise	☐	☐	☐	☐
7. Too much time from family relationships	☐	☐	☐	☐
8. Too much time from family responsibilities	☐	☐	☐	☐
9. Take too much of my time	☐	☐	☐	☐
10.Exercise is tiring	☐	☐	☐	☐
11.Exercise is fatiguing	☐	☐	☐	☐
12.Exercise is hard work	☐	☐	☐	☐
13.Spouse is not encouraging	☐	☐	☐	☐
14.Family is not encouraging	☐	☐	☐	☐
15. My breast cancer does no allow me to exercise	☐	☐	☐	☐
16. Vacation/travels do not allow me to exercise	☐	☐	☐	☐
17. Need to spend more time at work	☐	☐	☐	☐
18. Feel Lazy	☐	☐	☐	☐
19. Bad weather	☐	☐	☐	☐
20. No exercise habit	☐	☐	☐	☐
21. No professionals providing exercise consultations	☐	☐	☐	☐
22. Too depressed to exercise	☐	☐	☐	☐

APPENDIX H-EXERCISE SELF-EFFICACY

Please rate how sure you are that you can get yourself to perform your exercise routines regularly (3 or more times a week).

0	10	20	30	40	50	60	70	80	90	100
Cannot do at all					Moderately certain can do					Certain can do

	(0-100)
When I am feeling tired	_____
When I am feeling pain	_____
When I am feeling nausea or vomiting	_____
When I am feeling under pressure from work	_____
During bad weather	_____
During or after experiencing personal problems	_____
When I am feeling depressed	_____
When I am feeling anxious	_____
After recovering from cancer that caused me to stop exercising	_____
When I feel physical discomfort when I exercise	_____
After a vacation	_____
When I have too much work to do at home	_____
When visitors are present	_____
When there are other interesting things to do	_____
If I don't reach my exercise goals	_____
Without support from my family or friends	_____
During a vacation	_____
When I have other time commitments	_____
After experiencing family problems	_____

APPENDIX I

EXERCISE OUTCOME EXPECTANCY

Please respond to the following statements by indicating whether you strongly disagree, disagree, agree, or strongly agree to each. Place an X in the box which corresponds to your response. "Exercise" is any moderate physical activity that you do in your discretionary time on a regular basis for at least 20 minutes (i.e., walking, swimming, bicycling, sports).

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. Exercise makes me feel better physically	☐	☐	☐	☐
2. Exercise makes my mood better in general.	☐	☐	☐	☐
3. Exercise helps me feel less tired.	☐	☐	☐	☐
4. Exercise makes my muscles stronger.	☐	☐	☐	☐
5. Exercise is an activity I enjoy doing	☐	☐	☐	☐
6. Exercise gives me a sense of personal accomplishment.	☐	☐	☐	☐
7. Exercise makes me more alert mentally.	☐	☐	☐	☐
8. Exercise improves my endurance in performing my daily activities	☐	☐	☐	☐
9. Exercise helps to strengthen my bones.	☐	☐	☐	☐

APPENDIX J

Exercise Log

Height:________________ Weight:_________________

1. How are you doing?
   a. Have you noticed any changes in your fatigue in the last week ? Yes_____ No____ N/A_______
   b. Have you had any changes in your medication? Yes_____ No_____
   If yes, describe:___________________________

2. On a scale of 0 to 7, how would you rate your daily activity level this past week? (With 0 meaning severely disabled and 7 meaning normal with no complaints or symptoms)
   (circle) 0 1 2 3 4 5 6 7

3. On a scale of 0 to 7, how would you rate your appetite this past week? (With 0 meaning no appetite and 7 meaning good appetite)
   (circle) 0 1 2 3 4 5 6 7

4. On a scale of 0 to 7, how would you rate your sleeping this past week? (With 0 meaning did not sleep well and 7 slept well)
   (circle) 0 1 2 3 4 5 6 7

5. On a scale of 0 to 7, how would you rate your emotions or mood this past week? (With 0 felt terrible/awful and 7 meaning felt terrific)
   (circle) 0 1 2 3 4 5 6 7

6. How would you describe your current activity level? (circle the **one** percentage)
   100% I feel normal, I have no complaints or symptoms.
   90% I am able to carry on normal activities, but I have minor signs or symptoms of my illness.
   80% It takes a bit of effort to engage in my normal activity.
   70% I can care for myself, but am unable to carry on normal activity or do active work.

60% I require occasional assistance, but am able to care for most of my personal needs.
50% I require a considerable amount of assistance and frequent medical care
40% I require special care and assistance

7. How do you describe meaning of exercise for yourself ?

____

8. Do you have a previous exercise history? Yes_____ No_____

   What type of exercise ?______________________

9. Does any health professional provide an exercise consultation for you? Yes_____

   No_____

Now we would like to know about your exercise during the past 7 days. "Exercise" is any moderate physical activity that you do in your discretionary time on a regular basis for at least 20 minutes per session, three times per week in a typical week (i.e., walking, swimming, bicycling, sports).

10. Are you currently exercising ? Yes_____ No_____ if no, please jump to question 18

    by group__________ individual__________

11. What type, intensity, min/per session, frequency of exercise are you regularly doing during the last 5 weekdays? (Check all that apply)

Type of exercise	Perceived Exertion	Min /per session	Frequency	Total hours
Easy walking				
Yoga				
Cycling				
Ping pong				
Volley ball				
Calisthenic Class				
Home exercise				

Fast walking				
Folk dance				
Doubles tennis				
Tai-Chi				
Swimming				
Jogging				
Back packing				
Badminton				
Mountain climb				
Single tennis				
Running				
Others				

12. What type, intensity, min/per session, frequency of exercise are you regularly doing during the last Saturday and Sunday? (Check all that apply)

Type of exercise	Perceived Exertion	Min /per session	Frequency	Total hours
Easy walking				
Yoga				
Cycling				
Ping pong				
Volley ball				
Calisthenic Class				
Home exercise				
Fast walking				
Folk dance				
Doubles tennis				
Tai-Chi				

Swimming				
Jogging				
Back packing				
Badminton				
Mountain climb				
Single tennis				
Running				
Others				

13. What is your average heart rate during your exercise ?___________ N/A_______

14. How would you rate your breathing during your exercise?

_______Normal

_______Easy, slight change from resting

_______Heavier than when not exercising, but comfortable

_______Uncomfortably heavy/labored

_______Shortness of breath/panting

15. Do you sweat during your exercise? Yes_____ No_____

If yes, how much? Light_____ Moderate_____ Heavy______

16. How do you motivate yourself to exercise?

Self_____ Friend/Spouse_______ Dog______

Health_____ Muscle strength______ Other______

17. Do you feel good after exercise? Yes_____ No_____

18. Do you have any pain associated with exercise? Yes_____ No_____

If yes,

a. When do you have this pain?

During exercise_____ After______ Continuously_____________

b. Location of pain: Sharp_____ Dull______ Both______ Other_______

c. Severity of pain (scale of 1 to 10, 1=mild, 5=moderate, 10=severe)___________

d. Duration of pain (days/wks)______________

e. Has the pain prevented you from doing your exercise ? Yes_____ No_____

f. Have you sought medical treatment for this pain? Yes_____ No_____

Resolution__________________

19. Has any obstacle prevented you from exercise? Yes_____ No_____

If yes, what is it?

Illness_____ what kind of?_____________________

Symptom_____ what kind of?_____________________

Personal problem_______what kind of?_____________________

Injury_____ Vacation/Travel______

Work demands______ Family obligation_____

Care duties________ No Time_______

Laziness_____ Boredom_______

Weather______ No habit ______

No place_______

Other_______what kind of?_____________________

20. Do you have any ideas to help you restart (begin) your exercise behavior?

Yes_____ No_____

If, yes, what is it?__________________________________

21. If we provide exercise program to you, do you plan to participate in?

Yes_____ No_____

If yes, which type of exercise are you interested in?______________________

Borg Scale-Rating of Perceived Exertion (RPE)

This is a scale for rating perceived exertion. Perceived exertion is the overall effort or distress of your body during exercise. This feeling should reflect your total amount of exertion and fatigue, combining all sensations and feelings of physical stress, effort, and fatigue. Don't concern yourself with any one factor such as leg pain, shortness of breath or exercise intensity, but try to concentrate on your total, inner feeling of exertion. Try not to underestimate or overestimate your feelings of exertion; be as accurate as you can.

6	
7	very, very light
8	
9	very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

APPENDIX K

疲憊之乳癌病患運動行爲決定因素之探討

親愛乳癌病患：

近年來乳癌高居台灣女性癌症第二位且逐年增加。癌症引起的疲倦爲乳癌治療所引發之主要副作用之一。 癌症引起的疲倦與一般的疲倦是不同的，即使經由適當的休息及睡眠，症狀仍會持續。其不僅影響患者日常生活作息，更可能進一步對患者身心造成莫大傷害。一般而言，雖然適當的休息可適度減輕癌症引起的疲倦。然而，不適當的休息反而容易使疲倦進一步惡化且影響生活品質。因此，專家建議藉由規律運動可改善身體機能、增加自信、抒解心理壓力、提高生活品質進而有效預防或減輕疲倦的發生。在台灣採行此項治療之病患及相關訊息，極爲缺乏。因此，在台灣進行相關之研究將有助於醫療人員設計符合台灣乳癌病患的運動治療方式。

在美國國防部贊助下，加州大學舊金山分校護理學院特別在台灣與台大醫院合作，進行乳癌病患運動行爲及影響因素的了解，你的參與將提供寶貴的訊息。本研究將配合您的時間，在完成乳癌治療後第一次回診時，由研究者進行訪談，您可能需花費 30~45 分鐘回答相關問題。此外，我們將在您治療結束後三個月及及六個月時分別寄發兩份問卷，煩請撥冗填寫並寄回。在每次完成所有問卷填寫後，我們將提供精美小禮物一份，用以感謝您的參與。

如果您有興趣參與本研究，請與許心恬小姐聯絡，請撥 0916556769。我們將會與你聯絡並安排會談時間。我們衷心期盼您參與本研究。您的參與將會使乳癌患者的需求受到進一步的重視，將會幫助更多乳癌病患擁有更好的生活品質，感恩您！！

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加州大學舊金山分校及臺大醫院
個案參與研究同意書

疲憊之乳癌病患運動行爲決定因素之探討

一. 研究目的及背景：

由於乳癌高居台灣女性癌症排名第二位及癌症引起的疲倦爲乳癌治療所引發之主要副作用之一。根據專家建議運動爲一種有效減輕上述疲倦之方式。然而採行此項治療之病患及相關訊息，尚不清楚。 爲使乳癌病患對此項治療方式有進一步了解及採行，由美國國防部贊助，加州大學舊金山分校護理學院教授 Marylin Dodd 博士及博士班研究生許心恬小姐，於台灣與台大醫院黃俊升教授合作進行該項相關研究以確認影響乳癌病患運動行爲之主要相關因素。本研究屬自願參與方式，參與與否不會影響您原有的治療方式。

二. 研究過程：

1. 在乳癌治療結束後第一次回診、乳癌治療結束後三個月及六個月，填寫下列問卷相關訊息：年齡、職業、相關運動經驗、健康狀態、社會支持。30-45 分鐘可完成本問卷。
2. 我們將配合您的時間及地點完成問卷之填寫。
3. 研究生許心恬小姐將負責收集您的相關治療及檢驗結果以利本研究之進行。

三.不適或危險

1. 您無須回答任何使您感到不適的問題並可隨時停止受訪。
2. 本研究將配合您的身體狀況進行。
3. 資料隱密性：本研究維護您相關資訊的隱密性，將訊息轉換成學術所需之資訊並妥善保存。唯基於研究之理由，本計畫之研究者及贊助單位美國國防部可檢視相關資訊及研究成果。您的一切個人資料將不會在研究成果中公開。

四. 益處

您也許能或可能無法直接從參與本研究受益，然而，您所提供之寶貴訊息將使醫療人員進一步瞭解運動行爲的相關因素及其對乳癌病患之重要性。並可能進一步提供台灣乳癌病患更好的治療方式。

五. 其他選擇

您可拒絕參與本研究。

六. 花費

您無需負擔參與本研究所需之費用。

七. 補助

你將會在每次填寫問卷時獲得精美小禮物一份。

八. 相關問題

如果您對本研究有任何疑問，請聯絡許心恬小姐，請撥 0916556769, 或 Marylin Dodd 教授 002-1-(415)476-4320. 如研究進行中，有些因素造成您不適而不願繼續參與本研究，請於星期一至星期五早上八點至下午五點，您可聯絡黃俊升教授-(02) 23123456 分機 5683 或黃秀梨教授-分機 8429，反映問題所在或寫信至台北市中山南路七號，台大醫學院附設醫院外科部主治醫師黃俊升教授收。此外，您也可聯絡加州大學舊金山分校個案權益保護委員會來保障您在參與本計畫過程中的權益。該委員會之聯絡電話 002-1-(415)476-1814 或寫信至 Committee on Human Research, Box 0962, University of California, San Francisco/San Francisco, CA 94143, U.S.A.

九. 同意

您將可保有一份此同意書之影印本

本研究屬自願參與方式，您可隨時退出參與本研究此行為不會影響您的相關治療權益。

如果您願意參與本研究，請您在下列簽名或蓋章.

_______________ _______________________

日期 研究參與者簽名或蓋章.

_______________ _______________________

日期 經手同意書者簽名或蓋章.

乳癌病患運動行為探討

運動日記

身高________公分 體重_______公斤 BIA__________%

以下四個問題，請您圈選一個最能表達您情況的數字。

1. 如果用分數 0 到 10 分，上星期的每日活動程度，您會給幾分？

嚴重的無法做事(0 分) **正常沒有任何不舒服(10 分)**

0 1 2 3 4 5 6 7 8 9 10

2. 如果用分數 0 到 10 分，上星期的食慾狀況，您會給幾分？

無食慾(0 分) **食慾相當好(10 分)**

0 1 2 3 4 5 6 7 8 9 10

3. 如果用分數 0 到 10 分，上星期的睡眠狀況，您會給幾分？

睡眠非常差(0 分) **睡眠相當好(10 分)**

0 1 2 3 4 5 6 7 8 9 10

4. 如果用分數 0 到 10 分，上星期的情緒或心情，您會給幾分？

很糟糕(0 分) **感覺相當棒(0 分)**

0 1 2 3 4 5 6 7 8 9 10

5. 您現在的活動程度？(單選題---選一個最能表達你目前狀況)

1□ 感覺正常，沒有任何不舒服症狀(100%)

2□ 能做日常生活活動，但有輕微不適症狀，例如手臂外展有輕微疼痛(90%)

3□ 必須多花些力氣在日常活動(如拖地、種花),且有些不適症狀如頭暈、疲倦(80%)

4□ 可以自我照顧 (如吃飯、洗澡、如廁),但無法做一般的日常生活活動(70%)

5□ 自我照顧的個人需求(如吃飯、洗澡、如廁),偶爾需要協助(60%)

6□ 自我照顧的個人需求(如吃飯、洗澡、如廁),需要相當多的協助和醫療照顧(50%)

7□ 殘障,需要特殊的照護及協助(40%)

6. 下列情況最能描述你目前的情形?(規律的運動-如游泳、騎腳踏車、其他運動,是指中度程度的運動,一星期三次或以上,每次運動至少持續 20 分鐘以上)

1□ 從沒想過要運動

2□ 在這近來的六個月中,有慎重考慮要運動但未付諸任何行動

3□ 在這 30 天內有意願,已準備開始運動但並不規律的運動

4□ 規律的運動尚未達到 6 個月

5□ 規律的運動已達 6 個月以上

(散步非屬運動項目,但持續行走持續 20 分鐘則屬運動項目)

7. 運動讓您感覺很好嗎? 1□是 0□否

8. 您去運動的動機為何?(可複選)

1□自己想去 2□結交朋友或更多時間與朋友相處 3□與伴侶有更多時間互動

4□為了遛狗 5□為了健康著想 6□為了鍛練肌肉 7□其他________________

9. 您覺得運動對您的意義是？＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

10. 您先前是否有規律運動的經驗？ 1□是　0□否

規律運動已經持續多久？＿＿＿＿＿＿　何種運動?＿＿＿＿＿＿＿＿＿

11. 是否曾有醫療專業人員提供您運動諮詢? 1□是　0□否

12. 你最近有運動嗎？

1□有，

□ 跟團體一起運動　□跟伴侶或家人一起運動　□是自己一個人運動(可複選)

0□沒有，如果答案為沒有，請跳至問題 21。

13. 請您根據所提供的運動種類，以您過去七天(請分開描述--星期一至五及星期六、日)曾參與的情形，說明您每週運動次數、每次運動時間及運動平均所花費的力氣。 若參與的運動種類不在所列表格中，請自行列於表格最下方空白欄中(此項問題非常重要，煩請詳細填寫，請勿跳過，感謝您)。

問卷指引：

c.運動費力的程度請用下列量表，來評估自己運動費力的程度(6 分~20 分)。

6　7　8　9　10　11　12　13　14　15　16　17　18　19　20

極度輕鬆(7)　非常輕鬆(9)　少許輕鬆(11)　稍微費力(13)　費力(15)　非常費力(17)　極度費力(19)

運動種類	a. 每週運動次數 (次)		b. 每次運動時間 (分鐘)		c.運動費力的程度(6 分~20 分)	
	星期一至五	星期六及日	星期一至五	星期六及日	星期一至五	星期六及日
一般行走						

瑜珈						
騎腳踏車						
打乒乓球						
排球						
柔軟體操 (e.g.韻律舞蹈)						
快速行走						
土風舞						
元極舞						
雙人網球						
太極拳						
氣功						
游泳						
慢跑						
健行						
打羽球						
爬山						
單人網球						

c.運動費力的程度請用下列量表，來評估自己運動費力的程度(6 分~20 分)。

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

極度輕鬆 非常輕鬆 少許輕鬆 稍微費力 費力 非常費力 極度費力

運動種類	a. 每週運動次數 (次)		b. 每次運動時間 (分鐘)		c.運動費力的程度(6 分~20 分)	
	星期一至五	星期六及日	星期一至五	星期六及日	星期一至五	星期六及日
跑步						
其他						

14. 當您運動時，您的平均心跳為何？__________次/分，□ 沒有計算

15. 當您運動時，您的呼吸狀況為何？(單選題)

1□ 正常

2□ 與休息時比較，輕微加快但還能輕鬆應付

3□ 與沒有運動時比較，較喘但還能接受

4□ 呼吸急促/吃力的

5□ 呼吸困難/窘迫

16. 當運動時，您會流汗嗎？ 1□是 0□否；

如果是，汗量為? 1□少量 2□中量 3□多量(汗流浹背)

17. 當您運動時，是否會感到任何疼痛？1□是 0□否，如果答案為否，請跳至問題 21

如果是，何時您有此疼痛: 1□運動時 2□運動後 3□ 持續疼痛

疼痛部位:______________________________

疼痛感覺為何: 1□尖銳痛 2□鈍痛 3□兩者皆有 4□其他 ____________

疼痛的嚴重程度?（圈選一個數字）

1 2 3 4 5 6 7 8 9 10

輕度 中度 嚴重

疼痛會持續多久？______週______天______小時______分

18. 是否疼痛會阻止您的運動嗎？ 1□是 0□否

19. 您會因為這個疼痛而就醫嗎？ 1□是 0□否

疼痛緩解的方式:____________________

20. 您有任何方法幫助您重新開始運動？_________________________

21. 假如我們能提供您運動課程，您會參加嗎？1□是 0□否

如果是，哪種方式及運動課程您比較有興趣參加？

____

PIPER 疲倦測量表

請您根據以下的問題，圈選最能形容您“現在”疲倦的情形。此疲倦所指是因乳癌本身或其相關治療所引起身體、心理、精神、社會功能等方面的疲倦感。此疲倦感，即使有正常的睡眠，也常常無法獲得有效的抒解。

1. 您感覺這樣的疲倦感有多久 (從開始感到此種疲倦感到現在)？(請只填寫一項答案)

   a. _______ 分鐘

   b. _______ 小時

   c. _______ 天

   d. _______ 週

   e. _______ 個月

   f. _______ 其他

   g. _______無疲倦感 (若勾選此選項，請跳至問題 27)

2. 因疲倦，而造成您苦惱的程度為何? (下列 2-23 題，圈選號碼 [從 0 到 10]代表你的感覺)

完全沒影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

3. 在您居家日常生活、工作或學校活動方面，目前疲倦對其影響程度為何?

完全沒影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

4. 在您拜訪朋友或與朋友社交活動方面，目前疲倦對其影響程度為何?

完全沒影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

5. 在您性生活方面，目前疲倦對其影響程度為何? □無法作答

完全沒影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

6. 在參與您喜歡的活動 (休閒活動、運動、嗜好如種花、裁縫等)方面，目前疲倦對其影響程度為何?

完全沒影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

7. 如何形容您目前疲倦的程度(嚴重度)?

完全沒影響 極度疲倦

0 1 2 3 4 5 6 7 8 9 10

請用下列不同的感受來形容您目前的疲倦的情形?

8. 愉快的 極度不愉快的

0 1 2 3 4 5 6 7 8 9 10

9. 可接受的 完全無法接受的

0 1 2 3 4 5 6 7 8 9 10

10. 具保護性的(如同警告性質) 具破壞性的(對身體、心理、社會)

0 1 2 3 4 5 6 7 8 9 10

11. 正向的 (樂觀的) 負向的(悲觀的)

0 1 2 3 4 5 6 7 8 9 10

12. 正常的 不正常的

0 1 2 3 4 5 6 7 8 9 10

您目前的感覺是:

13. 強壯的 虛弱的

0 1 2 3 4 5 6 7 8 9 10

14. 清醒的 想睡的

0 1 2 3 4 5 6 7 8 9 10

15. 充滿朝氣的	無精打采的

0 1 2 3 4 5 6 7 8 9 10

16. 神清氣爽的	疲憊的

0 1 2 3 4 5 6 7 8 9 10

17. 精力充沛的	精力耗盡的

0 1 2 3 4 5 6 7 8 9 10

18. 能忍受的	不能忍受的

0 1 2 3 4 5 6 7 8 9 10

19. 放鬆的	緊繃的

0 1 2 3 4 5 6 7 8 9 10

20. 興奮的	憂鬱的

0 1 2 3 4 5 6 7 8 9 10

21. 可以全神貫注的	無法專心的

0 1 2 3 4 5 6 7 8 9 10

22. 記憶力佳的	記憶力差的

0 1 2 3 4 5 6 7 8 9 10

23. 可清楚思考的 **無法清晰思考的**

0	1	2	3	4	5	6	7	8	9	10

24.整體而言,您認為造成您疲倦的最直接因素是?

____

25.整體而言,您認為何種方法最能緩解您的疲倦?

____

26.您是否有其他的感受，可以更加貼切地形容您的疲倦？

____

27.您目前是否有其他不適症狀呢?

□否 □是，請描述症狀 ________________________________

我們想知道你一整天的精神狀況。在下列各項，<u>圈選號碼</u> (從 0 到 10)來代表你的感覺。

1. 一點都不累/疲倦 極度累/疲倦

0 1 2 3 4 5 6 7 8 9 10

2. 一點都不想睡 極度想睡

0 1 2 3 4 5 6 7 8 9 10

3. 一點都不精疲力盡 極度精疲力盡

0 1 2 3 4 5 6 7 8 9 10

4. 移動我的身體 一點都不費力 移動我的身體 需非常費力

0 1 2 3 4 5 6 7 8 9 10

5. 集中注意力 一點都不費力 集中注意力 需非常費力

0 1 2 3 4 5 6 7 8 9 10

6. 與人交談 一點都不費力 與人交談 需非常費力

0 1 2 3 4 5 6 7 8 9 10

7. 我完全不想躺下 我非常想躺下

0 1 2 3 4 5 6 7 8 9 10

8. 一點都沒活力 非常有活力

0 1 2 3 4 5 6 7 8 9 10

社會支持量表-針對運動方面

這份問卷主要想了解您本身運動行為的社會支持狀況。請您根據下列的描述，勾選您同意的程度，每題請勾選一個答案。“體能活動"是指因骨骼肌收縮造成身體移動來增加能量的消耗。“運動”是體能活動的一種，為有目的、有組織、重複性的身體活動，用來改善或維持身體體能狀態。 因此，運動”是定義為從事中等程度的規律運動 (如散步、游泳、騎腳踏車、其他運動) 一星期三次或以上，每次運動至少持續 20 分鐘以上.

	非常不同意	不同意	同意	非常同意
1. 有人可以陪我運動	□	□	□	□
2. 我跟那些喜愛動態(運動)生活的人，沒有深入交往	□	□	□	□
3. 沒有人教導我運動	□	□	□	□
4. 有人需要我幫助(他)她運動	□	□	□	□
5. 有些人和我一樣喜愛相同的體能活動	□	□	□	□
6. 別人不認為我是喜歡活動的人	□	□	□	□
7. 我有責任幫忙別人一起運動	□	□	□	□
8. 有一群人和我擁有相同體能活動的態度(例:愛運動)	□	□	□	□
9. 沒有人重視我的體能活動技巧與能力	□	□	□	□
10. 沒有人可以處裡家務讓我有時間運動	□	□	□	□

	非常不同意	不同意	同意	非常同意
11. 我和某些重視體能活動的人，有很不錯的情感	□	□	□	□
12. 有人可以和我討論與運動相關的事情	□	□	□	□
13. 我體能活動的能力獲得別人認同	□	□	□	□
14. 沒有人和我分享對體能活動的興趣與關心	□	□	□	□
15. 沒有人需要我幫助他(她)保持動態的生活	□	□	□	□
16. 當我有運動方面的問題時，有人可以請教	□	□	□	□
17. 我與他人保持密切的關係，來促進身心健康	□	□	□	□
18. 沒有人獎勵我繼續維持動態(運動)的生活模式	□	□	□	□
19. 我無法自在地與任何人談論運動	□	□	□	□
20. 有人欣賞我的運動天份與能力	□	□	□	□
21. 我和重視體能活動(運動)的人，沒有密切的關係	□	□	□	□
22. 沒有人喜歡從事與我相同的活動	□	□	□	□
23. 有人會為了幫助我運動而更改他(她) 的作息時間，來和我一起運動	□	□	□	□
24. 沒有人需要我和他(她)一起運動	□	□	□	□

健康狀態評估量表

這份問卷是詢問您對自己健康狀態的觀點，主要探討您的感受及您日常活動的執行程度。

請您在方格中勾選一個答案。

1. 一般來說，您的健康狀況是: 1□ 極好 2□ 非常好 3□ 好 4□ 普通 5□不良

2. 下列兩題針對您在一天正常的活動。 您目前的健康狀況會使這些活動有所限制嗎?

   若是，其限制為何?

	完全沒限制	有少許限制	有很大的限制
a.中等活動，如搬一張桌子，擦地板，快步走，游泳。	0□	1□	2□
b.爬 2~3 層樓梯	0□	1□	2□

3. 下列兩題針對您在過去一個月中，您是否因健康狀況改變而:

   a.完成比預期少的工作或日常活動 1□ 是 0□ 否

   b.造成特定工作或活動受限 1□ 是 0□ 否

4. 下列兩題針對您在過去一個月中，您是否因情緒問題(如焦慮或憂鬱)而:

   a.完成比預期少的工作或日常活動 1□ 是 0□ 否

   b.造成特定工作或活動受限 1□ 是 0□ 否

5. 在過去一個月中，您是否因疼痛而影響您的正常工作(包括家務及在外的工作):

   4□極為嚴重 3□非常多 2□中度 1□一點點 0□一點也沒有

6. 以下三個問題是針對您過去一個月的感受及所經歷的事.請勾選過去一個月中有多少時間有此感受(出現頻率)?

	總是	大部分時間是	許多時間是	有些時間是	少數時間是	沒出現
出現機率	100%	80%	60%	40%	20%	0%
a.您是否感覺平靜與平安	5□	4□	3□	2□	1□	0□
b.您是否感覺精力充沛	5□	4□	3□	2□	1□	0□
c.您是否覺得沮喪及憂鬱	5□	4□	3□	2□	1□	0□

7. 在過去一個月中，您是否因健康狀況或情緒問題影響您的社交活動

5□總是會影響(100%) 4□大部分時間會影響(80%) 3□許多時間會影響(60%)

2□有些時間會影響(40%) 1□少數時間會影響(20%) 0□沒出現(0%)

妨礙運動的因素

請根據下列敘述有關導致您不想運動或妨礙您運動的因素，勾選您的同意程度。請您在方格中勾選一個答案。請回答每個問題，如不確定請勾選您所認為的最佳答案！

	非常不同意	不同意	同意	非常同意
1. 運動場所太遙遠	□	□	□	□
2. 運動讓我感到尷尬	□	□	□	□
3. 運動讓我花不少錢	□	□	□	□
4. 運動場能使用之時間很不方便	□	□	□	□
5. 穿起運動衣服讓我看起來很好笑，所以不想運動	□	□	□	□
6. 能運動的地方太少	□	□	□	□
7. 我需要花較多時間與家人相處，所以不想運動	□	□	□	□
8. 我要擔當較多家庭責任，所以不想運動	□	□	□	□
9. 運動花太多我個人的時間	□	□	□	□
10. 運動讓我感到無聊	□	□	□	□
11. 運動讓我感到疲倦	□	□	□	□

12. 運動太辛苦	☐	☐	☐	☐
13. 伴侶不鼓勵我運動	☐	☐	☐	☐
14. 家人不鼓勵我運動	☐	☐	☐	☐
15. 疾病讓我無法運動	☐	☐	☐	☐
16. 度假/旅行讓我沒有時間運動	☐	☐	☐	☐
17. 我需要花較多時間在工作上，所以不想運動	☐	☐	☐	☐
18. 懶惰讓我不想運動	☐	☐	☐	☐
19. 天氣不穩定讓我不想運動	☐	☐	☐	☐
20. 沒有養成運動的習慣，所以不想運動	☐	☐	☐	☐
21. 醫療專業人員沒有提供您運動諮詢，所以不想運動	☐	☐	☐	☐
22. 情緒低落，提不起勁來運動	☐	☐	☐	☐

有任何上述之外的事情阻礙您運動嗎？假如有，是什麼？__________________

運動的自我效能

這份問卷是詢問您對自己面對各種情況，能繼續去運動的把握程度。在方格中勾選一個最可能答案的答案。此"運動"是指中度程度的身體活動,意指您從事規律運動 (如快步走、游泳、騎腳踏車、其他運動)一星期三次或以上，每次運動至少持續 20 分鐘以上。

	0	1	2	3	4	5	6	7	8	9	10
	一點都做不到					中等程度有把握做得到					非常有把握做得到
1. 當我感到疲倦	0	1	2	3	4	5	6	7	8	9	10
2. 當我感到疼痛	0	1	2	3	4	5	6	7	8	9	10
3. 當我感到噁心或想吐	0	1	2	3	4	5	6	7	8	9	10
4. 當我感到工作上的壓力	0	1	2	3	4	5	6	7	8	9	10
5. 當天氣很糟時	0	1	2	3	4	5	6	7	8	9	10
6. 當我處理私人問題時	0	1	2	3	4	5	6	7	8	9	10
7. 當我感到沮喪	0	1	2	3	4	5	6	7	8	9	10
8. 當我感到焦慮	0	1	2	3	4	5	6	7	8	9	10
9. 當我身體復原時，我會運動	0	1	2	3	4	5	6	7	8	9	10
10. 當我運動感到身體不適時	0	1	2	3	4	5	6	7	8	9	10
11. 當休假回來後	0	1	2	3	4	5	6	7	8	9	10

12. 當家中有許多事需要去做	0	1	2	3	4	5	6	7	8	9	10
13. 當家中有訪客	0	1	2	3	4	5	6	7	8	9	10
14. 當我還有其他有趣的事可以做	0	1	2	3	4	5	6	7	8	9	10
15. 當我無法達成預期運動目標時	0	1	2	3	4	5	6	7	8	9	10
16. 當家人及朋友不支持我	0	1	2	3	4	5	6	7	8	9	10
17. 在休假期間	0	1	2	3	4	5	6	7	8	9	10
18. 當我有其他約定的事或約會時	0	1	2	3	4	5	6	7	8	9	10
19. 當經歷家庭問題後	0	1	2	3	4	5	6	7	8	9	10

運動成效的期望

這份問卷是詢問您期望您現在所從事的運動，是否可產生以下的成果。請勾選您的同意程度。每題請勾選一個答案。

	非常不同意	不同意	同意	非常同意
1. 我覺得現在從事的運動能讓我有較好的身體狀態	□	□	□	□
2. 我覺得現在從事的運動能讓我有較好的心情	□	□	□	□
3. 我覺得現在從事的運動能讓我減少疲倦感	□	□	□	□
4. 我覺得現在從事的運動能讓我的肌肉更強壯	□	□	□	□
5. 我覺得現在從事的運動是一種享受	□	□	□	□
6. 我覺得現在從事的運動讓我很有成就感	□	□	□	□
7. 我覺得現在從事的運動讓我心智上較靈活	□	□	□	□
8. 我覺得現在從事的運動幫我改善每日活動的耐力	□	□	□	□
9. 我覺得現在從事的運動能協助增強我的骨質	□	□	□	□

第一階段　　基本資料　　填寫日期：___年___月___日

1. 姓名：____________ 病歷號碼：__________ 電話：____________

2. 通訊地址：____

3. 出生年月：_____年____月____日

4. 籍貫：1□閩南　2□外省　3□客家　4□原住民　5□其他____________

5. 教育程度：　1□不識字　2□識字，但未上過小學　3□國小　4□國中

　　5□高中（職）　6□大專　7□研究所以上

6. 婚姻狀況：1□未婚 2□同居 3□已婚 4□分居 5□離婚 6□喪偶 7□其他(單選)

7. 目前有哪些人與您一起同住? (可複選)

　　1□配偶/伴侶　2□小孩　3□兄弟姊妹　4□父母　5□親戚

　　6□朋友　7□傭人　8□同事　9□獨居　10□其他__________

8. 在您日常生活中，平均每天花費多少小時做家事？ ______小時______分鐘

9. 宗教信仰:　1□無　2□佛教　3□基督教　4□天主教　5□回教

　　6□道教　7□其他 ____________

10. 請問您目前的就業狀況？1□全職　2□半職　3□失業 4□退休 5□家管

　　6□學生　7□因乳癌或治療目前請假中　8□因乳癌或治療導致失去工作

　　9□其他________

11. 請問您目前的職業:________________________(請填寫並勾選)

　　1□無　2□家管　3□農　4□工　5□軍警　6□商　7□公教　8□醫護　9□其他

12.您的工作是屬於勞動工作嗎(例如搬重物)？1□是，為何種工作？__________2□不是

13.您家中每月總共收入為何？

A. a□2 萬元以下 b□2 萬元~4 萬元以下 c□4 萬元~6 萬元以下

d□6 萬元~8 萬元以下 e□8 萬元~10 萬元以下 f□10 萬元以上

B.這收入來自多少人? a□ 1 人 b□2 人 c□3 人 d□4 人 e□5 人 f□6 人

14.您最近一次月經的狀況？ 1□正常 2□因治療導致月經不規則或停經

3□停經前的不規則月經 4□停經 (若已停經，請跳至第 18 題)。

15.您最近一次月經平均持續幾天?__________天

16.您最近一次月經的平均量？ 1□微量 2□少量 3□中量 4□大量

17.您最近的經期是否改變？1□是 2□否

18.家族中是否有其他人患有乳癌? 1□是，共_________ 人 2□否

19.您目前是否有罹患其他慢性疾病？1□有 2□沒有

如果有，請勾選您目前罹患的疾病：(可複選)

1□高血壓 2□高血脂、高膽固醇 3□心臟病 4□腦中風 5□糖尿病

6□肺結核 7□氣喘 8□肺氣腫或慢性氣管炎 9□痛風 10□肝膽疾病

11□腎臟病 12□泌尿道疾病 13□青光眼 14□白內障 15□消化系統潰瘍

16□胃部或腸部疾病 17□貧血 18□腰椎骨刺、脊椎退化性變化

19□骨質疏鬆症 20□關節炎 21□風濕症 22□四肢循環障礙 (手腳發麻或冰冷)

23□聽力障礙 24□不清楚 25□其他______________

第二階段 **基本資料** **填寫日期：___年___月___日**

1. 姓名：__________病歷號碼：__________電話：□與之前填寫資料相同□更新________

2. 通訊地址：□與之前填寫資料相同□更新____________________________________

3. 目前有哪些人與您一起同住? (可複選)

   1□配偶/伴侶 2□小孩 3□兄弟姊妹 4□父母 5□親戚

   6□朋友 7□傭人 8□同事 9□獨居 10□其他___________

4. 您最近一次月經的狀況？ 1□正常 2□因治療導致月經不規則或停經

   3□停經前的不規則月經 4□停經 (若已停經，請不用回答下列問題)。

5. 您最近一次月經平均持續幾天?__________天

6. 您最近一次月經的平均量？ 1□微量 2□少量 3□中量 4□大量

7. 您最近的經期是否改變？1□是 2□否

8. 請問您目前的就業狀況？1□全職 2□半職 3□失業 4□退休 5□家管 6□學生

   7□因乳癌或治療目前請假中 8□因乳癌或治療導致失去工作 9□其他_________

9. 請問您目前的職業內容:_____________________________(請填寫並勾選)

   1□無 2□家管 3□農 4□工 5□軍警 6□商 7□公教 8□醫護 9□其他

10. 您的工作是屬於勞動工作嗎(例如搬重物)？1□是，為何種工作？_________2□不是

11. 過去一星期是否服用抗荷爾蒙藥物? 1□是 0□否 777□不清楚。

12. 過去一星期是否經驗過"熱潮紅"的症狀(例如胸口燥熱、皮膚發熱，噁心、頭暈、心悸、

    盜汗，以夜間為多) 1□是 0□否。如果答案為"是"，請回答下列問題

a. 如何形容您目前 “熱潮紅”的程度(嚴重度)

完全沒有 極為嚴重

0 1 2 3 4 5 6 7 8 9 10

b. 目前”熱潮紅”的症狀對您居家日常生活方面，其影響程度為何?

完全沒有影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

第三階段　　基本資料　　填寫日期：___年___月___日

1. 姓名：__________病歷號碼：__________電話：□與之前填寫資料相同□更新_______

2. 通訊地址：□與之前填寫資料相同□更新_______________________________

3. 目前有哪些人與您一起同住? (可複選)

   1□配偶/伴侶　2□小孩　3□兄弟姊妹　4□父母　5□親戚

   i.　6□朋友　7□傭人　8□同事　9□獨居　10□其他__________

4. 您最近一次月經的狀況？ 1□正常　2□因治療導致月經不規則或停經

   3□停經前的不規則月經　4□停經 (若已停經，請不用回答下列問題)。

5. 您最近一次月經平均持續幾天?__________天

6. 您最近一次月經的平均量？ 1□微量　2□少量 3□中量 4□大量

7. 您最近的經期是否改變？1□是 2□否

8. 請問您目前的就業狀況？1□全職　2□半職 3□失業 4□退休 5□家管 6□學生

   7□因乳癌或治療目前請假中 8□因乳癌或治療導致失去工作 9□其他_________

9. 請問您目前的職業內容:____________________________(請填寫並勾選)

   1□無　2□家管 3□農 4□工 5□軍警 6□商 7□公教 8□醫護 9□其他

10. 您的工作是屬於勞動工作嗎(例如搬重物)？1□是，為何種工作？_________2□不是

11. 過去一星期是否服用抗荷爾蒙藥物? 1□是　0□否　777□不清楚。

12. 過去一星期是否經驗過 "熱潮紅"的症狀 (例如胸口燥熱、皮膚發熱，噁心、頭暈、

    心悸、盜汗，以夜間為多)？ 1□是　0□否。

如果答案為 "是 "，請回答下頁 a、b 問題；如果答案為 "否 "請跳至下頁第 13 題。

a、 如何形容您目前 "熱潮紅"的程度(嚴重度)

完全沒有 極為嚴重

0 1 2 3 4 5 6 7 8 9 10

b、 目前"熱潮紅"的症狀對您居家日常生活方面，其影響程度為何?

完全沒有影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

13. 您覺得造成您乳癌產生的主要因素為何？(可複選)

1□壓力 2□本身個性(易緊張、焦慮、憂心) 3□家族遺傳 4□服用避孕藥或賀爾蒙

5□飲食習慣 (偏好高脂肪食物) 6□初經早(12 歲以前)或停經晚(55 歲以後) 7□三十歲以後生第一胎或未曾生育者 8□環境 9□其他__________

12.過去一星期是否經驗過“熱潮紅”的症狀 (例如胸口爆熱、皮膚發熱，噁心、頭暈、心悸、盜汗，以夜間為多)？ 1□是 0□否。

如果答案為 "是 "，請回答下頁 a、b 問題；如果答案為 "否 "請跳至下頁第 13 題。

a、 如何形容您目前 “熱潮紅”的程度(嚴重度)

完全沒有 極為嚴重

0 1 2 3 4 5 6 7 8 9 10

b、 目前"熱潮紅"的症狀對您居家日常生活方面，其影響程度為何?

完全沒有影響 有極大的影響

0 1 2 3 4 5 6 7 8 9 10

13.您覺得造成您乳癌產生的主要因素為何？(可複選)

1□壓力 2□本身個性(易緊張、焦慮、憂心) 3□家族遺傳 4□服用避孕藥或賀爾蒙 5□飲食習慣 (偏好高脂肪食物) 6□初經早(12 歲以前)或停經晚(55 歲以後) 7□三十歲以後生第一胎或未曾生育者 8□環境 9□其他__________

Table 3.1. Expert Validity- Mean Scores for Each Scales with 11 Experts (respond proper score level: 1-very improper; 2-improper; 3-fair; 4-good; 5-excellent)

# experts	Types of scale								
	Baseline	Piper fatigue	Lee fatigue	Social support	Health	Barriers	Self-efficacy	Outcome expectancy	Exercise diary
1	4.31	4.64	5.00	4.77	4.90	4.74	4.86	5.00	4.51
2	4.72	4.93	4.78	4.73	4.63	4.96	4.81	5.00	4.43
3	4.54	4.96	5.00	4.88	4.90	5.00	5.00	5.00	4.93
4	4.15	4.82	5.00	4.08	4.85	5.00	4.57	4.82	4.20
5	3.92	4.86	5.00	3.88	4.00	4.22	3.62	4.09	4.06
6	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.91
7	4.84	4.82	4.56	4.42	4.55	4.78	4.67	5.00	4.81
8	4.77	5.00	5.00	5.00	4.90	5.00	5.00	5.00	4.96
9	4.52	4.21	4.78	3.88	4.35	5.00	3.70	3.91	3.94
10	4.08	4.46	4.00	4.04	5.00	4.00	4.00	4.82	4.94
11	4.58	4.71	4.67	4.35	5.00	5.00	5.00	5.00	4.94

Table 3.2. Expert Validity- Average Mean of Mean Scores of Each Scales (n= 11 experts)

Type of scales	minimum	maximum	mean	SD
Baseline	3.92	5.00	4.49	.34
Piper fatigue	4.21	5.00	4.77	.25
Lee fatigue	4.00	5.00	4.80	.31
Social support	3.88	5.00	4.46	.44
Health	4.00	5.00	4.73	.32
Barriers	4.00	5.00	4.79	.35
Self-efficacy	3.62	5.00	4.57	.54
Outcome expectancy	3.91	5.00	4.79	.40
Exercise diary	3.94	4.96	4.60	.39

Table 3.3. Variables of Measurement and Timetable

Variables	Measurement	Items	Type of variable (range of each item)	T1	T2	T3
1.Cancer-Related Fatigue	Piper Fatigue Scale Lee Fatigue Scale	27 8	I(0-10) I(0-10)	X	X X	X X
2.Perceived health status	SF-12	12	I	X	X	X
3.Social support for exercise	Social Provisions Scale for Exercise	24	O(1-4)	X	X	X
4. Perceived barriers to exercise	Exercise Barriers Scale	22	O(1-4)	X	X	X
5. Exercise self-efficacy	Exercise Self-Efficacy Scale	19	I(0-10)	X	X	X
6.Exercise outcome expectancy	Outcome expectation for exercise	9	O(1-4)	X	X	X
7.Past exercise history 8. Exercise diary	 Exercise status, frequency, duration, intensity, MET	1 20	C(Y/N) O(1-5) I I	X X	 X	 X
9.Additional Variables	Demographic Profile	19		X	X	X

I: Interval data; C: Categorical data; O: Ordinal data

Table 4.1. Categories of Subjects' Characteristics at Baseline (T1)(n=196)

Categories	n	%
Age (years)		
20-29	8	4.08
30-39	30	15.30
40-49	77	39.29
50-59	58	29.59
60-69	20	10.20
70-79	3	1.53
Marital status		
Single	28	14.29
Married /Partnered	45	73.98
Separated	2	1.02
Divorced	13	6.63
Widowed	8	4.08
Employment		
Full Time	51	26.02
Part Time	12	6.12
Unemployed	1	0.51
Retired	18	9.18
Homemaker	73	37.24
Take Off due to Treatment	23	11.73
Laid Off due to Treatment	12	6.12
Other	6	3.06
Ethnicity		
Fukien	143	72.96
Mainland China	33	16.84
Ha-Ga	17	8.67
Aborigine	2	1.02
Other	1	0.51
Religion		
No religion	51	26.02
Buddhist	89	45.41
Christian	24	12.24
Catholic	2	1.02
Taoist	29	14.80
Other	1	0.51
Education levels		
Illiterate	4	2.04
Grade1-6	35	17.86
Grade7-9	20	10.20
High school	60	30.61
University/college	65	33.16
Graduate school	12	6.12
Average individual monthly income (1USD=32NT)		
Less than 20,000 (<625USD)	28	15.30
NT20,000~NT 39,999(625~1249USD)	74	40.43
NT40,000~NT 59,999(1250~1874USD)	56	30.60
NT60,000~NT 79,999(1875~2499USD)	13	7.10
NT80,000~NT 99,999(2500~3125USD)	8	4.37
>NT 100,000 (>3125USD)	4	2.19

Table 4.2. Medical Characteristics of the Subjects at Baseline (T1)

Categories	n	%
Disease stages (n=193)		
In situ	8	4.15
I	51	26.42
II	101	52.33
III	33	17.10
Types of cancer cells (n= 195)		
Infiltrating ductal carcinoma	184	94.36
Ductal carcinoma in situ	6	3.08
Infiltrating lobular carcinoma	4	2.05
Adenoid cystic	1	0.51
Types of surgery (n=195)		
Lumpectomy	8	4.10
BCS/partial	52	26.67
MRM	133	68.21
Wide incision	2	1.03
Types of adjuvant therapy (n=196)		
None	8	4.08
Chemotherapy only	70	35.71
Radiotherapy only	10	5.10
Radio- and chemotherapy	108	55.10
Current Tamoxifen Use (n=196)		
NO	74	37.75
YES	122	62.25
Numbers of Chronic diseases (n=196)		
0	110	56.12
1	52	26.53
2	21	10.71
3	7	3.57
4	2	1.02
5	2	1.02
6~9	2	1.02
Categories	Mean(SD)	Range
Duration of adjuvant treatment in days	155.27(51.96)	41-344
Chemotherapy only (n= 69)	122.39(24.85)	56-182
Radiotherapy only (n= 10)	42.10(1.29)	41-45
Both radiotherapy and chemotherapy (n=108)	183.19(43.85)	71-344

Table 4.3. Descriptive Statistics for Study Variables at T1 (baseline), T2, T3

Construct /stage (number of women)		T1(n=196)			T2(n=192)			T3(n=190)		
	# items	Score range (obtained)	Mean±SD	Cronbach α	Score range (obtained)	Mean±SD	Cronbach α	Score range (obtained)	Mean±SD	Cronbach α
Piper Fatigue Scale	22	0-9.95	4.88(2.14) (n=84)	0.97 (n=43)	0.27-9.14	4.97(1.87) (n=59)	0.96 (n=35)	0.68-9.05	4.84(1.97) (n=40)	0.98 (n=23)
Behavioral/Severity	6	0-9.8	4.92(2.44)	0.90(n=45)	1-10	4.92(2.42)	0.92(n=38)	1.67-10	4.82(2.20)	0.93(n=23)
Affective meaning	5	0-10	4.39(2.43)	0.93(n=80)	0-9.4	4.79(2.11)	0.89(n=55)	1.8-8.6	4.68(1.86)	0.93(n=39)
Sensory	5	0-10	5.33(2.32)	0.94(n=84)	0-10	5.40(2.03)	0.93(n=58)	0-10	5.08(2.25)	0.96(n=40)
Cognitive/mood	6	0-10	4.86(2.36)	0.93(n=84)	0-9.67	4.83(1.90)	0.89(n=59)	0-9.5	4.77(2.05)	0.95(n=40)
SF-12	12			0.85			0.87			0.85
PCS	12	24.41-60.77	42.73 (7.78)	0.72	29.97-64.21	47.26(7.72)	0.76	20.70-64.70	48.66(7.98)	0.76
MCS	12	18.09-64.64	46.23 (11.31)	0.85	9.6-65.75	48.44(10.78)	0.85	16.67-64.09	49.82(9.66)	0.79
Social Provisions Scale	24	27-92	60.81 (9.51)	0.87 (n=177)	36-92	61.91(8.64)	0.89 (n=172)	34-82	62.46(8.40)	0.89 (n=183)

PCS: Physical Component Summary; MCS: Mental Component Summary

Construct /stages (number of women)		T1(n=196)			T2(n=192)			T3(n=190)		
	# items	Score range (obtained)	Mean±SD	Cronbach α	Score range (obtained)	Mean±SD	Cronbach α	Score range (obtained)	Mean±SD	Cronbach α
Exercise Barriers Scale	22	1-3.09	2.06 (0.41)	0.91 (n=161)	1-3	2.00(0.38)	0.93 (n=166)	1-2.82	2.03(0.38)	0.92 (n=157)
Family,working, disease Personality, emotion	8	1-3	1.90 (0.45)	0.85	1-3.30	1.87(0.43)	0.90 (n=168)	1-2.8	1.96(0.40)	0.82 (n=157)
Clothes, environment,time	8	1-3.5	2.16 (0.49)	0.83	1-4	2.08(0.42)	0.84	1-3.5	2.09(0.42)	0.86
	6	1-4	2.01 (0.53)	0.80	1-3	1.95(0.49)	0.86	1-4	1.94(0.49)	0.88
Exercise Self-Efficacy Scale	19	0-10	4.46 (1.96)	0.93 (n=130)	0-10	4.69(2.15)	0.95 (n=131)	0-10	4.64(2.25)	0.96 (n=126)
Exercise outcome expectation	9	2-4	3.12 (0.42)	0.88	2-4	3.04(0.39)	0.89	1-4	3.03(0.47)	0.92
Exercise MET per day	1	2.57-214.38	41.15(39.33)	(n=122)	1.6-220.86	42.13(34.48)	(n=147)	3.75-162.26	41.44(33.12)	(n=143)
frequency per week)	1	1-28	7.52(4.86)	(n=122)	1-48	8.34(6.50)	(n=147)	1-37.00	7.92(5.45)	(n=143)
duration per week	1	10-570	108.49 (89.05)	(n=122)	8-490	110.81 (82.73)	(n=147)	15-435	118.90(82.58)	(n=143)
intensity per week	1	6-15	10.80(2.13)	(n=122)	6-20	11.37(2.46)	(n=147)	6-15.33	10.90(2.17)	(n=143)

Table 4.4. Predictor Variables Change Over Time (T1, T2, T3)(n=190)

	The ordinal version of Piper item 7		SF-12 PCS	SF-12 MCS	Social Support for Exercise Scale	Exercise Barriers Scale
	Mean Rank		M± SE	M± SE	M± SE	M± SE
T1	2.15	**T1**	42.73± .56	46.23± .81	60.82± .68	2.06± .03
T2	2.01	**T2**	47.29± .56	48.49± .77	61.93± .63	2.00± .03
T3	1.84	**T3**	48.67± .57	48.87± .70	62.50± .62	2.03± .03
		AIC	2885.29	4171.42	3955.14	
		Covariance Structure	CS	UN	UN	
df, Chi-Square	2, 23.68	**df, F**	2, 61.43	2, 11.81	2, 3.67	2, 1.822
P	< .000*	**P**	< .000*	< .000*	.039*	.170
Wilcoxon test significant	T1vs.T3, p< .000* T2vs.T3, p=.011*	**Pairwise significant**	T1vs.T2, p< .000* T1vs.T3, p< .000* T2vs.T3, p=.014*;	T1vs.T2, p=.002* T1vs.T3, p< .000*	T1vs.T3, p=.009*	None

Information criteria: AIC- Akaike's Information Criterion
UN: Unstructured
CS: Compound Symmetry

Table 4.5. Categories of Subjects' Exercise Diary at T1, T2, T3

variables /stages	T1		T2		T3	
Categories	Mean(SD)	Range	Mean(SD)	Range	Mean(SD)	Range
Weight(kg) (n= 196)	58.67(8.72)	38.80-88.00	58.73(8.78)	40.00-87.80	58.64(8.84)	40.60-89.60
Height (cm) (n= 196)	157.35(5.49)	142.00-172.00	157.42(5.52)	142.00-172.00	157.39(5.53)	142.00-172.00
BMI (kg/m^2) (n= 196)	23.72(3.53)	17.18-36.60	23.74(3.58)	17.15-37.20	23.71(3.58)	16.92-36.44
BIA (n=150)	31.40(7.38)	18.00-56.00	30.58(6.55)	14.00-49.00	31.04(6.23)	17.00-49.00
Categories/ n/ %	n	%	n	%	n	%
Karnofsky Score (n=196)						
100-Feel Normal	35	17.86	70	36.46	84	44.21
90-Minor signs or symptoms	122	62.24	93	48.44	82	43.16
80-Takes a bit of effort	35	17.86	28	14.58	23	12.11
70-Unable to carry on normal activity	2	1.02	1	.52	1	.53
60- Require Occasional Assistance	2	1.02	0	0	0	0
Exercise status (n=195)						
Never	8	4.10	8	4.17	5	2.63
Consider Exercise but no Action	60	30.77	27	14.06	22	11.58
Intend to Exercise but not Regular	51	26.15	48	25.00	38	20.00
Regular Exercise < 6 Months	54	27.69	72	37.50	53	27.89
Regular Exercise > 6 Months	22	11.28	37	19.27	72	37.89

Categories/stages	T1		T2		T3	
	n	%	n	%	n	%
Exercise make you feel good (n=196)						
NO	17	8.67	6	3.23	10	5.26
YES	178	90.82	180	96.77	180	94.74
N/A	1	0.50				
Exercise motivation						
For Health	176	89.80	165	85.94	164	86.32
For Self	65	33.16	79	41.15	75	39.47
For Meeting with Partner	18	9.18	8	4.17	15	7.89
For Meeting with Friends	20	10.20	15	7.81	16	8.42
For Walking Dog	6	3.06	3	1.56	5	2.63
For Other reason	11	5.61	11	5.73	9	4.74
For Building muscle	6	3.06	5	2.6	7	3.68
Exercise counseling via health professional						
NO	163	83.16	146	76.44	148	77.89
YES	32	16.33	44	23.04	41	21.58
N/A	1	0.51	1	.52		
Pain Associated with Exercise						
NO	93	47.45	113	58.85	120	63.16
YES	30	15.31	34	17.77	23	12.11
N/A	73	37.24	45	23.44	46	24.21
Interested in exercise program						
NO	87	45.08	101	54.89	104	55.32
YES	100	51.81	80	43.48	84	44.68
N/A	6	3.11	3	1.63		
Exercise history						
NO	124	63.26				
YES	72	36.74				

Table 4.6. Intercorrelation Matrix – the Relationships between Each of the Predictor Variables and Exercise Frequency

	1	2	3	4	5	6	7	8	9	10	11
1. age	—										
2. education	-.42**	—									
3. exercise history	.25**	- .12	—								
4. cancer-related fatigue	-.18*	.07	- .04	—							
5. physical health	-.01	.04	.01	-.44**	—						
6. mental health	.04	- .08	.08	-.34**	.19**	—					
7. social support	-.01	.07	.23**	- .10	.15*	.01	—				
8. barriers	-.04	.12	- .20**	.25**	- .27**	- .21**	- .33**	—			
9. self-efficacy	-.07	- .04	.20**	- .17*	.07	.15*	.39**	- .44**	—		
10. outcome expectancy	-.04	.05	.17*	- .12	.11	.08	.38**	- .37**	.38**	—	
11. exercise frequency	.13	- .06	.14	- .06	.13	-.05	.27**	- .19**	.28**	.08	—

Table 4.7. Hierarchical Linear Regression Results for Mean Scores of Exercise Self-Efficacy at T1

Step/predictor	R^2	$\triangle R^2$	$\triangle F$	df1	df2	Sig. $\triangle F$	Standardized β_a	t_a	Sig. a	Sr^2
Block 1	.30	.30	9.75	8	185	.000*				
Age							-.14	-2.04	.043*	.015
Education							-.72	-2.55	.012*	.024
Exercise history							.10	1.57	.119	
Piper #7							-.14	-1.90	.060	
Physical health							-.11	-1.61	.108	
Mental health							.05	.72	.474	
Social support							.23	3.41	.001*	.043
Barrier							-.82	-3.81	.000*	.054
Block 2										
education * barrier							.90	2.44	.016*	.022
Whole model (1+2)	.32	.02	9.56	9	184	.000*				

$\beta_{a:}$ standardized coefficients β in the whole model;
$t_{a:}$ test regression coefficients β in the whole model ($t^2=\triangle F$)
Sig. a: significant level for the whole model.
Sr^2_a : unique contribution of one independent variable in the whole model

Table 4.8. Hierarchical Linear Regression Results for Mean Scores of Exercise Outcome Expectancy at T1

Step/predictor	R^2	$\triangle R^2$	$\triangle F$	df1	df2	Sig. $\triangle F$	Standardized β_a	t_a	$Sig._a$	Sr^2_a
Block 1	.24	.24	6.602	9	184	.000*				
Age							1.26	3.11	.002*	.036
Education							1.16	2.91	.004*	.032
Exercise history							.04	.65	.516	
Piper #7							-.002	-.03	.974	
Physical health							2.10	3.55	.000*	.048
Mental health							-.06	-.92	.359	
Social support							.94	3.16	.002*	.038
Barrier							.68	1.82	.071	
Self-efficacy							.87	2.46	.015*	.022
Block 2										
Social support *barrier							-.97	-2.48	.014*	.023
age * physical health							-1.66	-3.19	.002*	.038
education * physical health							-1.31	-2.64	.009*	.026
physical health * self-efficacy							- .81	-2.06	.041*	.016
Whole model (1+2)	.32	.08	6.584	13	180	.000*				

Table 4.9. Hierarchical Linear Regression Results for Transformed Mean Scores of Exercise Frequency at T1

Step/predictor	R^2	$\triangle R^2$	$\triangle F$	df1	df2	Sig. $\triangle F$	Standardized β_a	t_a	$Sig._a$	Sr^2_a
Block 1	.22	.22	5.27	10	183	.000*				
Age							.72	2.571	.011*	.026
Education							.74	1.998	.047*	.016
Exercise history							.62	3.425	.001*	.046
Piper #7							.08	1.002	.318	.
Physical health							.11	1.574	.117	
Mental health							-.13	-1.924	.056	
Social support							.26	3.558	.000*	.050
Barrier							-.13	-1.673	.096	
Self-efficacy							.37	4.332	.000*	.073
Outcome expectancy							-.08	-1.153	.251	
Block 2										
history * self-efficacy							.72	-3.494	.001*	.048
age * education							.74	-2.074	.039*	.017
Whole model (1+2)	.29	.07	6.15	12	181	.000*				

Table 4.10. Dependent Variables Change Over Time (T1-2-3)(n=190)

	Self-Efficacy	Outcome Expectancy	Transformed Exercise Frequency
	M± SE	M± SE	M± SE
T1	4.46± .14	3.12± .03	1.63± .10
T2	4.70± .16	3.04± .03	2.10± .10
T3	4.65± .16	3.03± .03	2.00± .10
AIC	2337.85	571.87	2023.361
Covariance Structure	UN	UN	UN
df, F	2, 1.31	2, 3.43	2, 7.351
P	.283	.038*	.001*
Pairwise		T1-3, P=.016*	T1-2, P< .001* T1-3, P= .004*

Information criteria: AIC- Akaike's Information Criterion
UN: Unstructured
CS: Compound Symmetry

Table 4.11. Hierarchical Linear Regression Results for Exercise Outcome Expectancy from T1 Predict to T3

Step/predictor	R^2	$\triangle R^2$	$\triangle F$	df1	df2	Sig. $\triangle F$	Standardized β_a	t_a	$Sig._a$	Sr^2_a
Block 1	.13	.13	28.12	1	186	.000*				
Exercise outcome at T1							.25	3.29	.001*	0.049
Block 2	.19	.06	1.36	9	177	.212				
Age							-.02	-.24	.812	
Education							.09	1.14	.257	
Exercise history							.11	1.43	.156	
Piper #7							-.03	-.39	.696	
Physical health							1.07	2.13	.035*	0.020
Mental health							-.12	-1.67	.096	
Social support							.92	2.27	.025*	0.023
Barrier							-.08	-1.00	.317	
Self-efficacy							.12	1.52	.131	
Block 3										
t1physical health * social support							-1.46	-2.13	.035*	0.020
Whole model (1+2)	.21	.08	4.19	11	176	.000*				

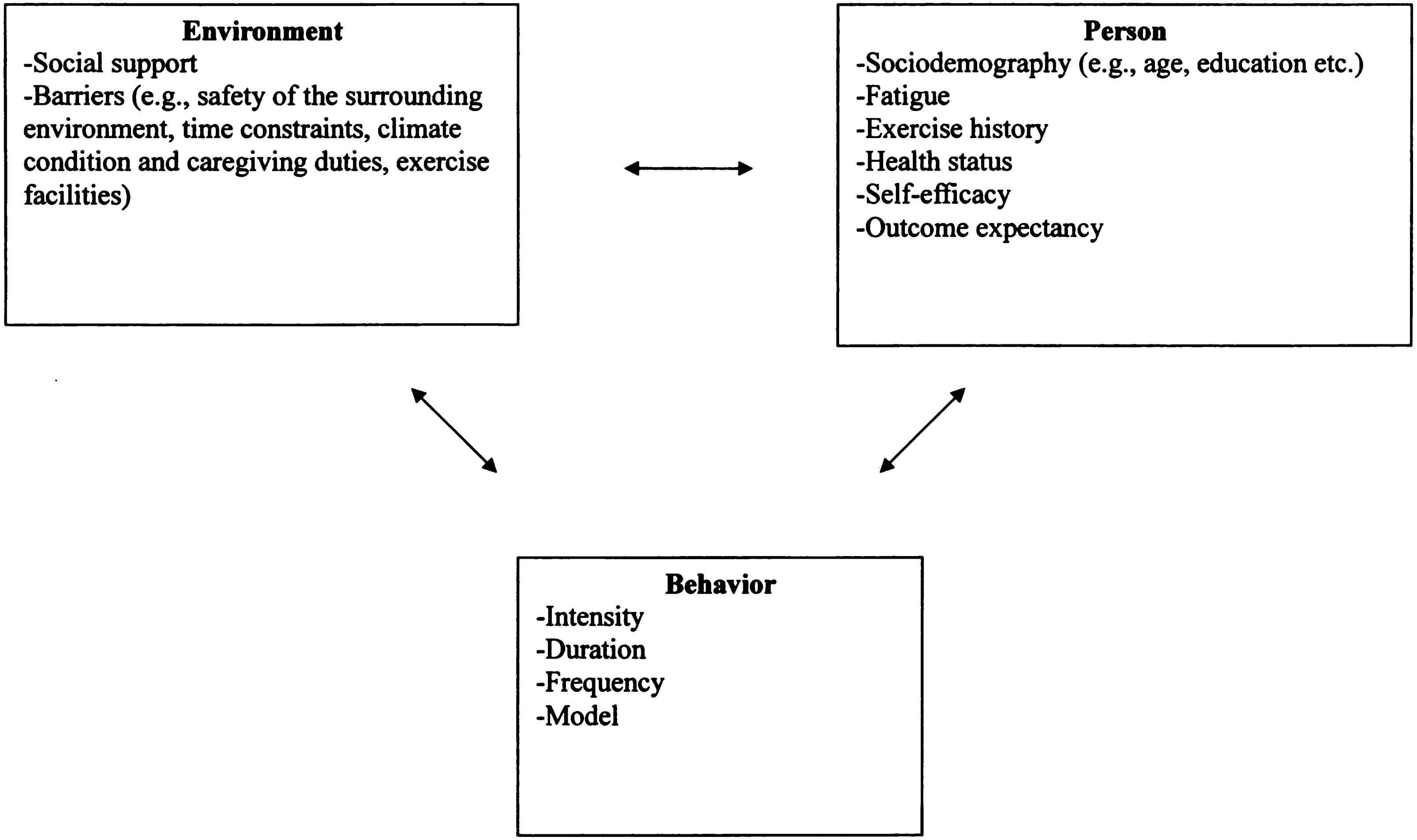
Table 4.12. Hierarchical Linear Regression Results for Transformed Mean Scores of Exercise Frequency from T1 Predict to T2

Step/predictor	R^2	$\triangle R^2$	$\triangle F$	df1	df2	Sig. $\triangle F$	Standardized β_a	t_a	$Sig._a$	Sr^2_a
Block 1	.12	.12	24.512	1	188	.000*				
Exercise frequency at T1							.35	4.59	.000*	.093
Block 2	.18	.06	1.291	10	178	.239				
Age							-1.17	-2.40	.018*	.025
Education							.01	.13	.894	
Exercise history							-.13	-1.74	.083	
Piper #7							-.08	-.92	.360	
Physical health							-.12	-1.52	.131	
Mental health							.88	2.57	.011*	.029
Social support							-.63	-1.76	.080	
Barrier							.56	2.02	.044*	.018
Self-efficacy							-.07	-.82	.414	
Outcome expectancy							-.03	-.41	.682	
Block 3										
age * social support							1.45	2.44	.016	.026
mental health * barrier							- .91	-2.36	.020	.024
Whole model (1+2)	.23	.05	3.962	13	176	.000*				

Table 4.13. Hierarchical Linear Regression Results for Transformed Mean Scores of Exercise Frequency from T1 Predict to T3

Step/predictor	R^2	$\triangle R^2$	$\triangle F$	df1	df2	Sig. $\triangle F$	Standardized β_a	t_a	$Sig._a$	Sr^2_a
Block 1	.04	.04	7.176	1	187	.008*				
Exercise frequency at T1							.21	2.76	.006*	.035
Block 2	.11	.07	1.340	10	177	.212				
Age							-1.43	-2.87	.005*	.038
Education							-.02	-.29	.772	
Exercise history							.06	.69	.493	
Piper #7							.04	.41	.686	
Physical health							-.04	-.54	.592	
Mental health							.07	.92	.362	
Social support							-1.11	-2.99	.003*	.041
Barrier							.16	1.93	.055	
Self-efficacy							.01	.17	.863	
Outcome expectancy							.16	1.99	.048*	.018
Block 3										
age * social support							1.95	3.19	.002*	.047
Piper #7 * history							- .27	- 2.71	.008*	.033
Whole model (1+2)	.20	.09	3.323	13	175	.000*				

igure 1.1- Relationships among the Three Classes of Determinants in Triadic Reciprocal Causation



ocial Cognitive Theory-Bandura, A. (1997b). Self-Efficacy: the Exercise of Control. New York, NY: W. H. Freeman and Company.

Figure 1.2-Three Interacting Cognitive Processes of Social Cognitive Theory

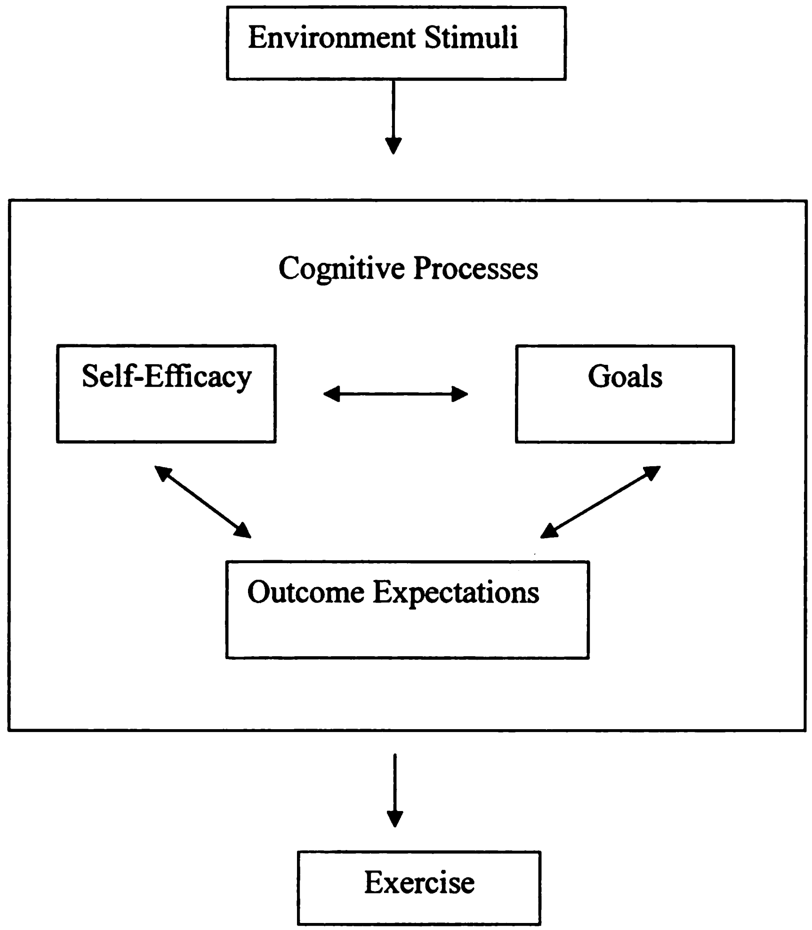
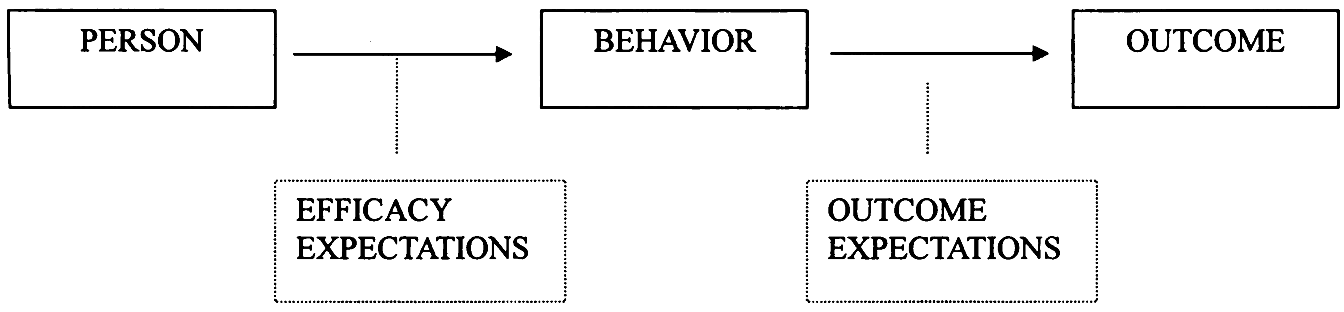


Figure 1.3: Diagrammatic Representation of the Difference between Efficacy Expectations and Outcome Expectations



igure **3.1.** Determinants of Exercise Model

: Categorical data; I: Interval data; O: Ordinal data