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Exercise Motivation for Breast Cancer Risk Reduction

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EXERCISE MOTIVATION FOR BREAST CANCER RISK REDUCTION

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ABSTRACT

According to The International Agency for Cancer Research (IARC), 25% of worldwide breast cancer cases are due to having a sedentary lifestyle and being overweight or obese (2002). Unfortunately, less than 50% of women participate in physical activity as recommended by the Centers for Disease Control (CDC) and the American College of Sports Medicine and more than 25% do not participate in any physical activity at all (CDC, 2005).

Perceptions of increased personal risk and self-efficacy have been shown to promote exercise participation, and as such, are key elements of protection motivation theory, used as the theoretical framework to guide this study (Courneya & Hellsten, 2001; Dishman & Buckworth, 2001; Petro-Nustas, 2002; Rippetoe & Roger, 1987; Rogers, 1983). The purpose of this study was to determine whether risk and/or health information could motivate a woman to exercise and to explore the accuracy of a woman's perception of breast cancer risk in relationship to her Gail risk score.

Women were blocked by Gail risk status into one of two groups, high risk (n = 46) or average risk (n = 50), and then randomly assigned to one of two treatments: control (general written health information) or experimental (specific written health information) to determine which treatment was more effective in motivating women (high risk versus average risk) to exercise. Pearson's chi-square test and analysis of variance were used to assess statistical differences between groups. Multiple regression analysis was used to understand the effects of the independent variables (actual risk, perceived risk, and self-efficacy) on the dependent variable (exercise behavior). Self-efficacy, but not Gail risk made a significant unique contribution to the prediction of exercise behavior, $F(2, 80) = 7.15$, $p = .001$. Self-efficacy alone correlated with exercise behavior, accounting for 15.0 % of the variance; perceived susceptibility did not predict exercise behavior or predict above and beyond Gail risk estimates. However, a positive correlation was found between Gail risk and perceived susceptibility. The current study provides support for the potential role of the health care provider in promoting physical activity by providing individuals with tailored instructions to achieve greater levels of self-efficacy.

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CHAPTER 1

INTRODUCTION

Breast cancer is the most common occurring cancer and the second leading cause of cancer death among women in the United States (American Cancer Society (ACS), 2007). The International Agency for Cancer Research (IARC) estimates that 25% of worldwide breast cancer cases are due to being overweight or obese and having a sedentary lifestyle (2002). The percentage of women who are obese and sedentary has dramatically increased over the last several decades (USDHHS, 1996). The President's Council on Physical Fitness and Sports estimates that 34 million adults are considered obese (2005). And while there is growing evidence to suggest that physical activity will decrease a woman's risk for breast cancer, many women choose not to exercise. Increasing age, decreasing education and income are just some of the reasons why more than 60 percent of women in the United States do not engage in the recommended daily amount of physical activity to reduce their risk for many diseases, including breast cancer (USDHHS, 1996).

Theoretical predictors of exercise behavior should increase our understanding so as to encourage participation and positively affect the outcome. The development of a theoretical model for the nurse is imperative to facilitate health-related behavioral change. This study attempted to learn more about specific interventions that might directly or indirectly motivate women to exercise to reduce breast cancer risk based upon the chosen theoretical framework of protection motivation theory. Protection motivation theory suggests that perceptions of vulnerability and severity, response efficacy, and self-efficacy can influence health-related intentions and behaviors (Wurtele & Maddux, 1987). Within this holistic framework, such research develops the body of knowledge needed to provide evidence-based nursing care to facilitate health-related behavioral change (Burns & Grove, 2005).

Background and Significance

Breast cancer is the most common occurring cancer and the second leading cause of cancer death among women in the United States. It is estimated that one in eight women will be diagnosed with breast cancer in their lifetime (Ghafoor et al., 2003). The incidence of breast cancer has steadily risen over the past century. In 2007, about 240,510 women will be diagnosed with breast cancer and 40,460 are expected to die from breast cancer in the United States (American Cancer Society, 2007). During 2000-2004, 95% of all breast cancers were diagnosed in women 40 years or older, accounting for 97% of all breast cancer deaths.

There are several factors which have been associated with an increased risk of breast cancer. The more commonly known risk factors for breast cancer include age, gender, race, family history, early menarche, and late menopause (Brewster & Helzlsouer, 2001; Key, Verkasalo, & Banks, 2001; Marteau & Lerman, 2001; Vogel, 2000). While most of the known risk factors for breast cancer cannot be changed, a couple of potentially modifiable lifestyle factors are slowly gaining recognition. The American Institute for Cancer Research estimates that about 30 to 40% of all cancers could be prevented by maintaining a healthy weight and getting regular exercise (2005). Adiposity and weight gain seem to have a direct impact on both pre and postmenopausal breast cancer risk and adult weight gain has been shown to increase the risk of breast cancer mortality regardless of menopausal status (Huang et al., 1997; McTiernan, 2003).

Women who infrequently exercise and have a body mass index above the 50^{th} percentile appear to have a 27% and 53%, respectively, higher lifetime risk of breast cancer (Fraser & Shavlik, 1997).

According to the U.S. Department of Health and Human Services (1996, 2000, 2007), physical activity is necessary to reduce the risks associated with a variety of diseases, including breast cancer, and those individuals who participate in the greatest amount of physical activity seem to have the lowest risk. Women of all ages can benefit from a moderate amount of physical activity and longer duration or greater intensity derives the greatest benefit. Women who participate in moderate to vigorous activity more than 3 to 4 hours per week have been shown to have a 30% to 40% decreased risk of breast cancer, respectively, over sedentary women, regardless of their menopausal status (McTiernan, 2003). An equal risk reduction has been seen in both pre and postmenopausal women who engage in physical activity for Caucasian, Hispanic, African American (John, Horn-Ross, & Koo, 2003), as well as Asian-American women (Yang, Bernstein, & Wu, 2003).

Initiation and adherence to exercise regimens has been typically low, especially among women. Less than 50% of women participate in physical activity as recommended by the Centers for Disease Control (CDC) and the American College of Sports Medicine and more than 25% are not active at all (CDC, 2005). And attrition rates have been shown to be as high as 50% within the first six months of exercise initiation (Dishman, 1982).

Various factors have been attributed to exercise initiation and adherence among women. Perceptions of increased personal risk, greater perceived benefits and fewer perceived costs have been have been shown to influence exercise participation (Cappelli et al., 2001; Courneya & Hellsten, 2001; Janz & Becker, 1984). Exercise readiness, self-efficacy, and social support have been found to be significant predictors of exercise behavior (Litt, Kleppinger, & Judge, 2002). Physical activity that focuses on enjoyment, competence, and social interaction seems to enhance long-term exercise adherence (Landry & Solmon, 2002; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Schwarzer & Fuchs, 1996). Perceived self-efficacy seems to be the most common factor in increasing the likelihood of an individual committing to action and engaging in exercise behavior (Bandura, 1986; Dishman & Buckworth, 2001; Dzewaltowski, 1989; Guillot, Kilpatrick, Hebert, & Hollander, 2004; Schwarzer and Fuchs, 1995). Health information and accurate exercise knowledge were shown to enhance self-efficacy in the initiation and maintenance of regular exercise (Corwyn, Flynn, and Brent, 1999; Fitzgerald, Singleton, Neale, Prasad, & Hess 1994; Netz, Raviv, & Shulamith, 2004). Perceived vulnerability to a health condition can drive a person's choices of health-related behaviors (Petro-Nustas, 2002). An individual must feel vulnerable or susceptible to a problem in order to affect behavior (Poss, 2001). Motivation, in particular, has consistently been shown to be a strong indicator of exercise behavior (Dishman, 1991; Girvin & Reese, 1990) and outcome expectations seems to play a major role in exercise motivation (Bandura, 1977, 1982; Dishman & Buckworth, 2001; Schwarzer & Fuchs, 1995).

Threat of a disease or health problem has been shown to predict behavior, yet there is limited research regarding risk perception, to explain and predict participation in health prevention and maintenance behaviors, including exercise participation, especially among high risk women. Behavioral change is more likely if a woman believes that by changing her behavior, the risk of an adverse health outcome can be reduced, especially in women who are deemed to be at high risk for breast cancer (Helmes, 2002; Marteau & Lerman, 2001; Prentice-Dunn, Floyd, & Flournoy, 2001; Rippetoe & Rogers, 1987). A woman who perceives that she is susceptible to breast cancer is more likely to participate and adhere to health-related behaviors in order to reduce her risk of developing the disease (Petro-Nustas, 2002). Individuals will follow through with self-care activities more readily if their concerns are understood, are taught about their health threat along with specific health promoting behaviors, and encouraged to participate in their own care (Cameron, 1996; DiMatteo, et al., 1993; Phister-Minogue, 1993).

Prior research examining the association between physical inactivity, obesity, and increased breast cancer risk has serious implications for all women, especially those with a family history of breast cancer. It has become increasingly more important for a woman to understand her risk of developing breast cancer as more options become available for primary prevention. The Gail model (Gail et al., 1989) has been widely used in research to calculate a woman's actual (objective) breast cancer risk (5-year and lifetime), easily identifying those individuals who would be considered at higher risk for development of the disease. Risk has been shown to predict exercise behavior, yet we know little about how women understand risk and even less about whether actual (objective) or perceived (subjective) risk is more influential in changing health-related behaviors (Bottorff et al., 2004: Quillin et al., 2004). It is unclear whether actual risk needs to match perceived risk in order to be an effective strategy for cancer prevention (Audrain-McGovern, Hughes, & Patterson, 2003; Chalmers & Thomson, 1996). Health care providers need to be aware of a woman's risk perception to adequately address her needs and psychosocial concerns so as to enhance her perception of control in breast cancer susceptibility. Clients need a strong incentive to change behavior that threatens or affects their health status. Such evidence-based research can aid the nurse in making appropriate recommendations to women in order to reduce their risk of developing breast cancer.

Accurate risk perceptions should lead to desired health-related behavioral change, especially in those individuals who are deemed to be at high risk for a threat or disease such as breast cancer. While health information and accurate exercise knowledge have been shown to enhance self-efficacy and improve physical activity levels, efforts by health care practitioners to promote physical activity are limited (Dishman & Buckworth, 1996, 2001; Eden, Orleans, Mulrow, Pender, & Teutsch, 2002; Fitzgerald, Singleton, Neale, Prasad, & Hess, 1994). Risk and self-efficacy play a critical role in motivating women to exercise, and are key elements of protection motivation theory, used as the theoretical framework to guide this study.

Study Purpose

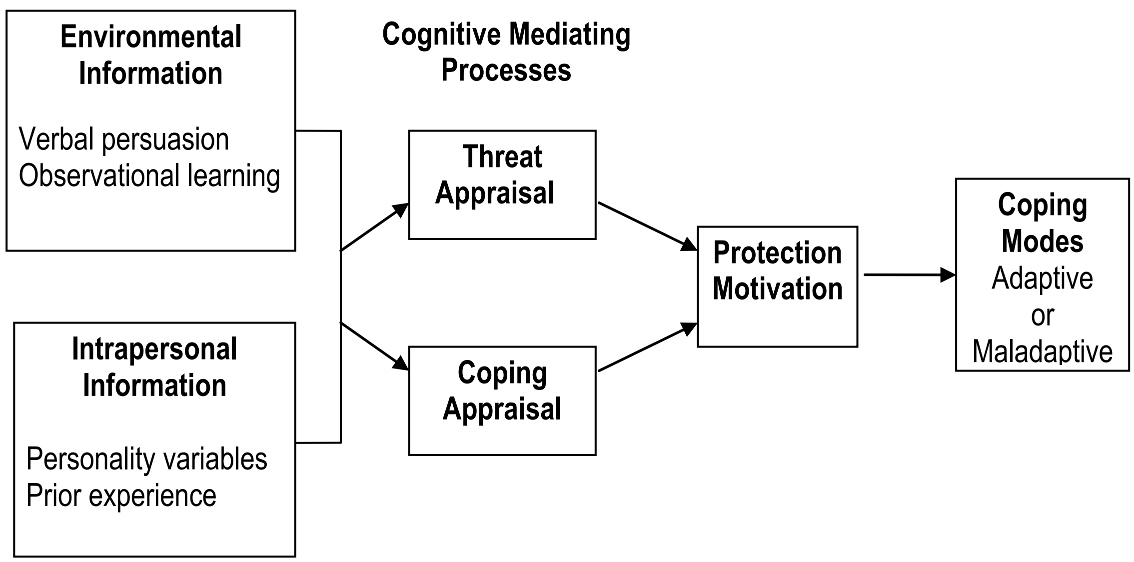
The overall purpose of this study was to determine whether risk and/or health information and accurate exercise knowledge could motivate a woman to exercise and to gain a deeper understanding of how risk perception impacts exercise behavior. The specific aims and/or objectives were to (a) determine whether a woman's risk of developing breast cancer based on her Gail model score can motivate her to participate in regular physical activity in order to reduce her risk of developing the disease, (b) determine whether general health information versus specific health and exercise information can predict participation in regular physical activity, especially in woman who are at higher risk of developing breast cancer, (c) explore the accuracy of a woman's perception of breast cancer risk in relationship to her Gail model score, and (d) test the main framework of protection motivation theory within a healthcare setting.

Conceptual Framework

The protection motivation theory (see Figure 1) suggests that two processes (threat appraisal and coping appraisal) predict protection motivation, and is reflected in an individual's intention to perform a recommended protective health behavior (Rogers, 1983). Threat appraisal refers to perceptions of vulnerability and the severity of a disease. An individual's perception of developing a health condition (vulnerability), and the individual's belief in the disabling consequences imposed by the health condition (severity), along with fear arousal (potential for harm), are significant enough to motivate behavioral change. Coping appraisal refers to perceptions of response efficacy and self-efficacy. Response efficacy supports the belief that the behavior undertaken by the individual will alleviate or reduce the threat associated with the health condition, while self-efficacy allows the individual to believe that the behavior undertaken can be successfully performed.

Information about a health threat is responsible for initiating the cognitive mediating processes of threat and coping appraisal, which in turn appraise either a maladaptive or adaptive response(s). Sometimes there is only one maladaptive or adaptive response (e.g., smoking and smoking cessation) to a health problem, but for many other health problems (e.g., lack of exercise, obesity), there can be more than one maladaptive or adaptive response.

Figure 1. Protection motivation theory (adapted from Rogers, 1983).


Environmental Information
Verbal persuasion
Observational learning
Intrapersonal Information
Personality variables
Prior experience
Cognitive Mediating Processes
Threat Appraisal
Coping Appraisal
Protection Motivation
Coping Modes
Adaptive
or
Maladaptive

Threat appraisal determines the likelihood of a maladaptive response while coping appraisal determines the likelihood of an adaptive response. The perception of threat (increased severity and vulnerability) decreases the likelihood of the maladaptive response while intrinsic rewards (e.g., physical and psychological pleasure) and extrinsic rewards (e.g., peer approval and social norms) increase the likelihood of the maladaptive response (Maddux, 1993). The adaptive response of coping appraisal (response efficacy, self-efficacy, and response costs) suggests that as response efficacy and self-efficacy increase, so does the likelihood of engaging in the recommended health behavior, unless the perceived costs (e.g., inconvenience, difficulty of the task, personal time, and effort) outweigh the benefits (Maddux, 1993; Rogers & Prentice-Dunn, 1997). Physical inactivity and breast cancer is an example of one such health problem. In this example, a person’s physical inactivity is the maladaptive response. Factors increasing the likelihood of physical inactivity are intrinsic rewards such as bodily satisfaction with one’s self and extrinsic rewards such as peer approval from others who are overweight and inactive. Factors decreasing the likelihood of continued physical inactivity are beliefs about the severity of breast cancer and one’s vulnerability to developing the disease. The adaptive response is to start exercising based on the belief that engaging in physical activity will decrease one’s risk of developing breast cancer and the belief that one can successfully perform the physical activity. Factors decreasing the likelihood of physical activity are response costs such as the lack of personal time or the difficulty of the task. The two cognitive mediating processes (threat and coping appraisal) mediate the persuasive effects of a fear appeal by eliciting protection motivation, as measured by behavioral intentions to adopt the recommended coping response (Rippetoe & Rogers, 1987).

Antecedents of Protection Motivation

Environmental and intrapersonal informational sources are precursors to the two cognitive mediating processes of threat appraisal and coping appraisal (Rogers, 1983). Environmental sources include both verbal persuasion and observational learning. An example of verbal persuasion can be a fear appeal, while an example of observational learning can be when an individual observes what happens to others or is exposed to information. Intrapersonal sources include personality variables or characteristics such as family history and educational level, and prior experience with similar threats. Information about a health threat initiates the cognitive mediating processes of threat and coping appraisal resulting in protection motivation and subsequent adaptive or maladaptive coping.

Outcomes of Protection Motivation

The evaluation of the maladaptive or adaptive response leads to protection motivation and results in either an adaptive or maladaptive coping mode for the individual (Rogers, 1983). Feedback from maladaptive and adaptive coping can cause reappraisals of the cognitive mediating processes for the individual. Adaptive coping (beneficial to health) and maladaptive coping (detrimental to health) are determined by protection motivation, which is a function of threat and coping appraisal. Protection motivation has been shown to be synonymous with behavioral intention, suggesting that behavioral intentions are an index of the effects of persuasion (Rogers & Prentice-Dunn, 1997).

Philosophical Underpinnings

Protection motivation theory originated to explain the effects of fear appeals upon attitudes and behaviors (Rogers, 1975). The revised model (Rogers, 1983) emphasizes the changes produced by persuasive communications and is now employed primarily as a model for health decision-making and action (Maddux, 1993; Rippetoe & Rogers, 1987; Robberson & Rogers, 1988). The framework of protection motivation suggests an influence by expectancy-value theory models (Edwards, 1954; Hovland, Janis, & Kelley, 1953). Expectancy-value theories have been applied to the structure of attitudes, prediction of behavior, and persuasion in the social health field in an attempt to gain an understanding of psychological phenomena. In expectancy-value theory, behavior is adopted as a function of expectancy that a given behavioral act will be followed by some consequence and the value of the consequence.

Protection motivation theory makes several underlying assumptions regarding the concept of protection motivation. Attitude and behavioral change is a function of the amount of protective motivation aroused by the cognitive appraisal processes, not as a result of an emotional state of fear (Rogers, 1975; Rogers, 1983; Tanner, Hunt, & Eppright, 1991). Fear is seen as an intervening variable between the emotional response and the stimulating event and plays an indirect role in threat appraisal. Fear indirectly influences attitude and behavior change by affecting the appraisal of the severity of the threat (Rogers, 1983). Assumptions of the protection motivation theory as related to health care in nursing include the following:

1. Individuals are motivated to engage in behaviors that promote well-being and strive to maintain homeostasis.

2. An individual will choose to take action based upon a perceived threat to her well-being and the desire to affect a positive health outcome at an acceptable cost.

3. An individual is more likely to participate in a health related behavior when the perceived threat is understood and her educational needs are met.

4. Health care professionals are instrumental in affecting a behavioral change through appropriate educational instruction and goal directed behavioral interventions.

5. An individual is more likely to comply with a behavior when given specific instructions by health care professionals to positively affect a change that is within her control in order to achieve a positive outcome.

6. The more positive the association with the behavior, the more likely it is that the individual will commit to actions resulting in initiation and adherence to exercise.

Theoretical and Practical Implications

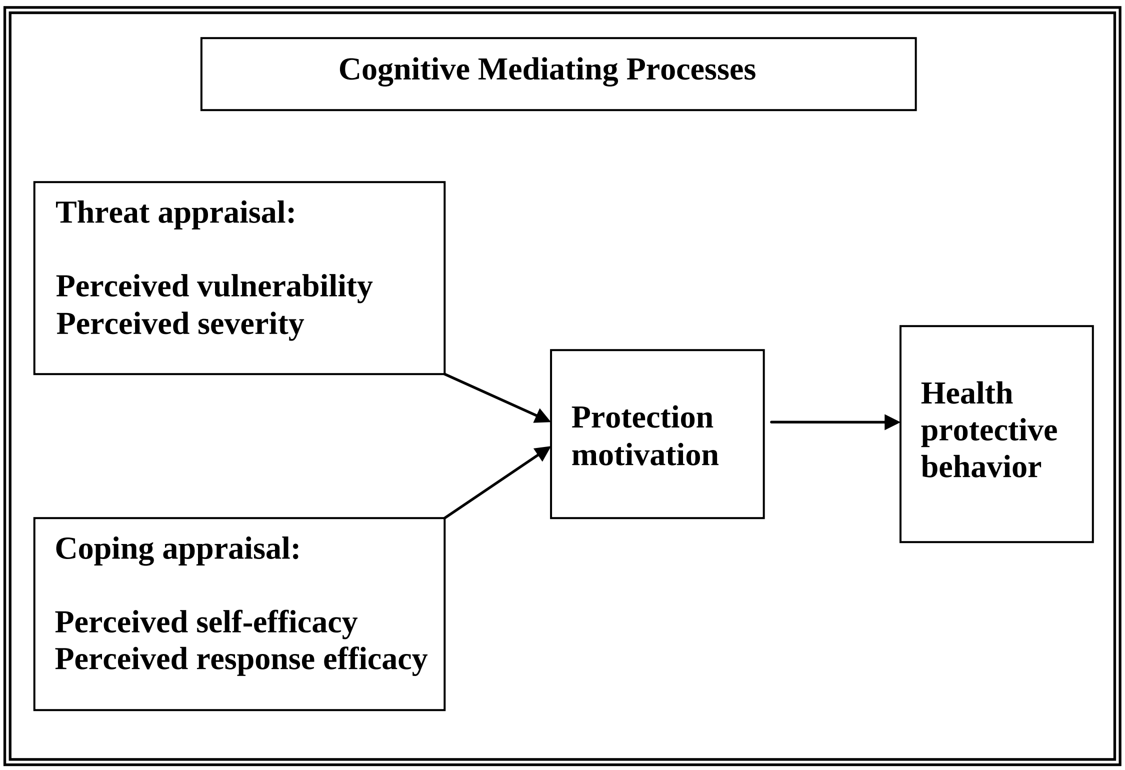
Rogers (1983) suggests that protection motivation is best measured by the assessment of behavioral intentions, consistent with predictions and findings as suggested by the theory of reasoned action and planned behavior (Ajzen & Fishbein, 1980; Maddux, 1993). Preventative actions can be aimed at health enhancement or disease prevention using positive or negative fear appeals (Robberson & Rogers, 1988). Wurtele and Maddux (1987) suggest that this framework is useful in contributing to an understanding of the arguments that should be contained in persuasive communications designed to produce behavioral change and predict behavioral intentions, suggesting that behavioral intentions are a product of the effects of persuasion. Theoretical predictors of exercise should increase our understanding of determinants of exercise behavior so as to enhance participation. The development of a theoretical model for the nurse is imperative to facilitate health-related behavioral change.

Health-related intentions and behaviors are determined by the main components (threat and coping appraisal) of protection motivation (see Figure 2). The cognitive mediating processes of threat (perceived vulnerability and perceived severity) and coping appraisal (response efficacy, and self-efficacy) lead an individual towards protection motivation and health protective behavior (Courneya & Hellsten, 2001; Helmes, 2002; Maddux & Rogers, 1983; Rogers, 1983; Wurtele & Maddux, 1987). Protection motivation mediates the relationship between threat and coping appraisal and is thought to be synonymous with behavioral intentions and can be applied to exercise behavior (Milne, Sheeran, & Orbell, 2000).

Conceptual and Operational Definitions

The main components (threat and coping appraisal) of protection motivation theory were used to examine the effects of perceived risk and self-efficacy in motivating women to exercise and facilitate health protective behavior. Operational definitions of risk, self-efficacy, and exercise behavior as they relate to the conceptual model of protection motivation were developed for use in this study. Both perceived risk and/or actual risk have been shown to influence health behaviors. Theoretically, a threat must be recognized before health-promoting behaviors will occur. Perceived risk was defined as a woman's perceived probability of developing breast cancer over a designated period of time. Actual risk constitutes measurable indicators of breast cancer risk (age, personal and family history, early menarche, nulliparity or late first birth after age 30, number of

Figure 2. Main components of protection motivation theory (adapted from Rogers, 1983).


Cognitive Mediating Processes
Threat appraisal:
Perceived vulnerability
Perceived severity
Protection motivation
Health protective behavior
Coping appraisal:
Perceived self-efficacy
Perceived response efficacy

previous atypical biopsies, and race), which were used to calculate a Gail model score. According to the Gail model, a woman was considered to be at high risk if she had a Gail model score of at least a 1.67% and at average risk if she had a Gail model score of less than a 1.67%. By examining the more commonly known risk factors, a woman's susceptibility to breast cancer was easily ascertained, thus identifying those individuals who were considered to be at higher risk of developing the disease (Gail et al., 1989).

Self-efficacy refers to an individual's perceived skills and ability to effectively perform specific behaviors such as physical activity and is considered to be the most important mediator of behavioral change (Bandura, 1986). Self-efficacy is positively related to motivation and is extensively regulated by behavioral intention and planning (Bandura, 1977, 1982). Individuals who are confident about their abilities to achieve a particular goal have optimal motivation for maintaining exercise (Dishman & Buckworth, 2001). Giving a woman specific written health and exercise knowledge information should enhance self-efficacy and increase her likelihood of exercise participation.

Exercise behavior refers to either a woman's participation in 30 minutes a day of moderate intensity activities five or more days a week and/or 15-20 minutes of vigorous intensity activities three or more days a week, as core recommendations set forth by The President's Council on Physical Fitness and Sports (2005) and the American College of Sports Medicine (2007). Moderate intensity activities have been defined as those that require exerting some physical effort, but not exhausting (e.g. brisk walking). Vigorous intensity activities have been defined as those requiring more exertion causing a noticeable increase in the heart rate, breathing depth and frequency, and sweating (e.g. jogging).

Chapter 1 has outlined the impact and incidence of breast cancer as well as highlighted many of the known risk factors for breast cancer in the United States, most of which cannot be changed. One potentially modifiable risk factor, physical inactivity, was discussed along with the various factors attributed to exercise motivation. Chapter 1 introduced the conceptual framework that was used to guide the research. The primary variables of interest in this study (risk, self-efficacy, and exercise behavior) were conceptually and operationally defined.

CHAPTER 2

LITERATURE REVIEW

This chapter focuses on the state of the science related to physical activity and breast cancer risk reduction; adiposity and weight gain; physical activity, exercise motivation and theory; risk perception; and self-efficacy. The contributing factors to exercise adherence, specifically motivation, will be discussed within the context of several theoretical frameworks. Both risk and self-efficacy can positively affect exercise behavior and as such, are key elements of protection motivation theory, the theoretical framework that was chosen to guide this study.

Physical Activity and Breast Cancer Risk

Women who participate in moderate to vigorous levels of physical activity appear to have a much lower incidence of breast cancer. The majority of studies have shown that women who participate in moderate to vigorous activity ≥ 3 to 4 hours/week have a 30% to 40% breast cancer risk reduction, respectively, over sedentary women, regardless of their menopausal status (McTiernan, 2003). A similar breast cancer risk reduction has been seen among Caucasian, Hispanic, African American women, Native American women and Asian-American women (McTiernan et al., 2003). Regardless of the type or amount of activity, women who remain more physically active throughout life appear to have a much lower risk of developing breast cancer than those who are sedentary.

Premenopausal Women

When looking at young women who participate in recreational activities, Lagerros, Hsieh, and Hsieh (2004) found that women who participated in recreational physical activity between the ages of 12 to 24 years had a significantly reduced breast cancer risk as adults; each one-hour increase in recreational physical activity per week during adolescence supported a 3% risk reduction in adult breast cancer. Women (aged 40 and younger) who averaged at least 3.8 hours of activity per week compared to inactive women had an odds ratio (OR) of 0.28 (95% confidence interval (CI) = 0.16 - 0.50) for parous and 0.73 (95%CI = 0.38 - 1.41) for nulliparous women of breast cancer suggesting that women who maintain activity of 1 - 3 hours/week can reduce their risk of premenopausal breast cancer by approximately 30% as compared to inactive women and those that exercise ≥ 4 hours/week can reduce their risk by > 50% (Bernstein, Henderson, Hanisch, Sullivan-Halley, & Ross, 1994). Likewise, Verloop, Rookus, Kooy, & Leeuwen (2000), found that women (aged 20 to 54 years) who participated in recreational physical activity had a 30% reduced risk of breast cancer compared with inactive women (OR = 0.70; 95% CI = 0.56 - 0.88), and in women who engaged in both recreational and occupational activity, a 39% reduction in risk of breast cancer was seen as compared with inactive women (OR = 0.61; 95% CI = 0.44 - 0.85).

Postmenopausal Women

A similar breast cancer risk reduction has been seen among postmenopausal women who participate in physical activity throughout life. Breast cancer risk reduction was seen among older women (80 years or younger) who sustained activity throughout life, particularly after menopause. For women who sustained physical activity throughout life an odds ratio was found of 0.58 (95% CI = 0.40 - 0.83) compared to those women who were never active (Friedenreich, Courneya, & Bryant, 2001). Among women aged 50 to 74 years (Patel et al., 2003), those who were most physically active at baseline had a 29% lower incidence of breast cancer in comparison to inactive women (95% CI = 0.49

- 1.02). Dorn, Vena, Brasure, Freudenheim, and Graham (2002) found that participation in strenuous physical activity (≥ 3.5 hours/week) was associated with a 35 to 45% reduced breast cancer risk among postmenopausal women (OR = 0.50; 95% CI = 0.28 - 0.90), aged 40 to 85. The effects appeared to be stronger for women who were most active 20 years prior to the interview and for those who were consistently active throughout their lifetime. And among women with more stable weight during adulthood (Carpenter, Ross, Paganini-Hill, & Bernstein, 1999), breast cancer risk was reduced for those women aged 55 to 64 who exercised more than 4 hours/week for at least 12 years (OR = 0.59, 95% CI = 0.40 - 0.88) and in those who exercised vigorously during the most recent 10 years (OR = 0.52, 95% CI = 0.32 - 0.85).

Racial and Ethnic Differences

While breast cancer risk reduction was most often appreciated in more active Caucasian women, there was a similar risk reduction seen among other racial/ethnic women who were physically active throughout life. An equal risk reduction has been seen in pre and postmenopausal women who engage in physical activity among Caucasian, Hispanic, African American women (John, Horn-Ross, & Koo, 2003), as well as Asian-American women (Yang, Bernstein, & Wu, 2003).

A 40% reduced risk of breast cancer was seen in both premenopausal and postmenopausal women with the highest versus lowest tertile of average lifetime activity (premenopausal: adjusted OR = 0.74, 95% CI = 0.52 - 1.05; postmenopausal: adjusted OR = 0.81, 95% CI = 0.64 - 1.02) in Latina, African-American, and white women aged 35 to 79 years (John Horn-Ross, & Koo, 2003), although the dose-response trend was not significant (P_{trend} = 0.09). However, when stratified by age, there was a significant risk reduction found among the most physically active women under the age 50 years (adjusted OR = 0.69, CI = 0.49 - 0.98), as well as those 50 years of age and older (adjusted OR = 0.79, CI = 0.62 - 0.99). Risk reductions were similar for all types of activities (recreational, occupational, and household) among premenopausal women; however, in postmenopausal women, they were limited to occupational activity; although, considering the intensity of activities, there were similar risk reductions for moderate and vigorous activities. In distinguishing between moderate and vigorous activities, Hispanic and non-Hispanic women, aged 35 to 74 years, who participated in vigorous physical activity had an approximate 50% lower risk of breast cancer (OR = 0.34, 95% CI = 0.22 - 0.51 for Hispanic; OR = 0.60, 95% CI = 0.41 - 0.89 for non-Hispanic White women) compared with women reporting no vigorous physical activity (Gilliland, Li, Baumgartner, Crumley, & Samet, 2001). Both premenopausal and postmenopausal Hispanic women showed breast cancer risk reduction with increasing level of activity; however, risk reduction with increasing activity was protective only among postmenopausal non-Hispanic White women.

Among Asian-American women, aged 25 to 74 years who participated in physical activity throughout life, a significantly reduced breast cancer risk was seen as compared with inactive Asian women (Yang, Bernstein, & Wu, 2003). Women who exercised > 3 metabolic equivalent (MET) hours/week and had active jobs for ≥ 16 years had a significantly lower risk (OR = 0.44, 95% CI = 0.21 - 0.90) compared with women who exercised < 3 MET hours/week and did not have active jobs.

Higher levels of strenuous physical activity during young adulthood were associated with a reduced risk of breast cancer later in life among African American women (Adams-Campbell, Rosenberg, Rao, & Palmer, 2001). Exercise data were gathered from women, aged 21 to 69 years, about hours per week of participation in strenuous activity during high school, age 21, age 30, and age 40. The trends were significant for the OR to decrease with increasing exercise ($p < 0.01$). Odds ratio for ≥ 7 hours/week of strenuous exercise at age 21 relative to < 1 hour/week was significantly reduced for breast cancer overall regardless of menopausal status, although were more often significant for premenopausal women.

Type of Activity

There is no clear consensus from the literature as to what type of activity (recreational, occupational, household chores, and/or other activities) confers the greatest breast cancer risk reduction. Friedenreich, Bryant, & Courneya (2001) found that among women, aged 80 years or younger, there was a decreasing risk of breast cancer with increasing activity for postmenopausal women (OR = 0.70, 95% CI = 0.52 - 0.94) and that household and occupational activity conferred the largest risk reductions for the highest versus the lowest quartile of activity (OR = 0.57, 95% CI = 0.41 - 0.79 and OR = 0.59, 95% CI = 0.44 - 0.81), respectively. Likewise, Coogan et al. (1997) found that women aged 74 years or younger who held heavy-activity occupations had a lower risk of breast cancer than women with sedentary jobs (OR = 0.82, 95% CI = 0.63 - 1.08), as did women who held medium activity occupations (OR = 0.86, 95% CI = 0.77 - 0.97) or light activity occupations (OR = 0.92, CI = 0.84 - 1.01) with a decreasing trend in the ORs from sedentary to heavy work ($P = 0.007$). And McTiernan et al. (2003) found that postmenopausal women who engaged in 1.25 to 2.5 hours/week of brisk recreational walking over their lifetime (at ages 18, 35, and 50 years) had an overall 18% decreased risk of breast cancer (RR = 0.82, 95% CI = 0.68 - 0.97) compared with inactive women and a 30% risk reduction was observed in women who were in the lowest tertile (<24.1) of body mass index (RR = 0.70, 95% CI = 0.51 - 0.97). Regular recreational physical activity during adolescence and early adult life (Rockhill et al., 1999) reduces breast cancer risk, as does physical activity later in adult life (Friedenreich et al., 2001; Patel, Calle, Bernstein Wu, & Thun, 2003).

Amount of Activity

While moderate to vigorous exercise seems to confer the greatest breast cancer risk reduction, only a few studies have measured the frequency, duration, and/or intensity of activities performed by women (Ainsworth, 2000). Breslow, Ballard-Barbash, Munoz, and Graubard (2001) found that recreational activity was associated with a 67% reduction in breast cancer among women, 50 years and older, who consistently engaged in high (versus low) levels of recreational activity (RR = 0.33, 95% CI = 0.14 - 0.82, P for trend = 0.03). Although moderate activity, such as walking, appears to be as effective as more strenuous activity in reducing breast cancer risk (Rockhill et al., 1999). Women, aged 30 to 55 years, who were followed for 16 years and participated in an average of 7 or more hours of moderate or vigorous physical activity per week had an approximate 20% lower risk of breast cancer (multivariate-adjusted relative risk = 0.82, 95% CI = 0.70 - 0.97) compared with those reporting less than 1 hour of such physical activity per week. John, Horn-Ross, and Koo (2003) measured lifetime history of regular participation in recreational activity recording the intensity of the activity, the number of weekly hours of participation and the duration of each activity episode and found that women who were most active had the highest risk reduction for breast cancer and that vigorous and moderate activity offered similar risk reduction.

Adiposity and Weight Gain

Physical inactivity and obesity have been linked with increasing breast cancer risk. Research has shown that women who infrequently exercise and have a body mass index above the 50th percentile have a 27% and 53%, respectively, higher lifetime risk of breast cancer (Fraser & Shavlik, 1997). According to the U.S. Department of Health and Human Services (USDHHS), 56% of women in the United States are considered either overweight or obese (2000) which reflects a 62.9% increase since 1991.

The underlying mechanism of the protective effect of physical activity on breast cancer risk is not completely understood. It has been suggested that the potential benefits of exercise are related to hormones and energy balance (IACR, 2002; Friedenreich, 2001). Balancing energy intake with energy output helps to maintain a healthy weight and avoid obesity. Excess calories are stored as fat and circulating estrogen is primarily produced in fat tissue, thus increasing estrogen levels and the likelihood of developing breast cancer. Physical activity and decreased caloric intake helps to control weight, increase lean body mass, and decrease overall fat and estrogen levels in the body, and have been shown to decrease the risk of developing and dying from breast cancer (USDHHS, 2007).

Increased abdominal fat is associated with hyperinsulinemic insulin resistance and increased bioavailability of insulin growth factor 1 (IGF1). Estrogen and IGF1 have both been shown to interact with each other to increase proliferative and invasive activity in human breast cancer cells and increase breast cancer risk (Lee, Weng, Jackson, & Yee, 1997; Pollak, Schernhammer, & Hankinson, 2004). Exercise can reduce abdominal fat accumulation and has been shown to reverse the development of hyperinsulinemic insulin resistance (Pratley & Hagberg, 1995). Breast cancer may be promoted in obese women as a result of a synergistic interaction between estrogen concentrations derived from aromatization of testosterone to estrogen in adipose tissue and hyperinsulinemia and increased IGF1 concentrations, suggesting that lifestyle intervention such as exercise regimens and reduction of obesity would be best started around the age of 45 years when in situ ductal carcinoma would begin progression towards invasive disease (Stoll, 2000).

Adiposity and weight gain appear to have a direct impact on both pre and postmenopausal breast cancer risk. Adiposity appears to reduce breast cancer incidence in premenopausal women, but not postmenopausal women, and adult weight gain appears to increase the risk of mortality regardless of menopausal status (Huang et al., 1997; McTiernan, 2003). Among premenopausal women, breast cancer mortality was found to be positively associated with current BMI and weight gain since age 18 years, and among postmenopausal women, breast cancer mortality associated with increasing BMI, associations were even stronger. The relative risk (RR) were 1.22 (95% CI = 0.77 - 1.92, P for trend = .27) and 1.90 (95% CI = 1.26 - 2.88, P for trend = .09) for a current BMI > 28 kg/m^2 compared with a BMI of 21 kg/m^2 or less, and for weight gain of >20 kg versus ≤ 2 kg change, RR were1.27 (95% CI = 0.71 - 2.29, P for trend = .03) and 2.44 (95% CI = 1.40 - 4.25, P for trend = 0.01) for pre and postmenopausal women, respectively. In a multiethnic cohort study (Galanis, Kolonel, Lee, & LeMarchand, 1998), breast cancer patients at the 75th percentile or greater for body mass index had a 2.2 times increased risk of dying of the disease as compared with lighter patients. Likewise, an American

Cancer Society cohort study (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003) found that mortality increased significantly with increasing body mass index (BMI); those with BMIs of 25 - 29.9, 30 - 34.9, 35 - 39.9, and ≥ 40 had relative risks of dying from breast cancer of 1.34, 1.63, 1.7, and 2.12, respectively (P for trend < 0.001).

Several studies suggest that there is a higher risk of postmenopausal breast cancer seen in women who have an increased body mass index and greater abdominal fat (Huang, et al., 1997; McTiernan et al., 2003; Stoll, 2000). Ziegler et al. (1996) found that Asian-American women in their fifties, above the median adiposity for their age group, who gained more than 10 pounds in the preceding decade had three times the risk of breast cancer compared to women below the median adiposity with no recent weight change (RR = 3.01, 95% CI = 1.45 - 6.25). Recent weight loss (RR = 0.69, 95% CI = 0.29 - 1.66) was consistently associated with reduced risk relative to women who recently gained 11 pounds or more (RR = 2.26, 95% CI = 1.21 - 4.21). Additional risk seems to be correlated in women who are overweight with a family history of breast cancer, suggesting that exercise alone may be insufficient to reduce breast cancer risk in women with a family history, unless combined with a lean body mass index. According to Carpenter, Ross, Paganini-Hill, and Bernstein (2003), gaining more than 29.2% of weight relative to weight at age 18 was positively associated with breast cancer risk in women with a positive family history (OR = 3.36, 95% CI = 2.15 - 5.26, P trend < 0.0001).

Physical Activity

Physical activity and exercise are terms that are often used interchangeably. Physical activity is defined as any bodily movement produced by skeletal muscles that result in an expenditure of energy (Caspersen, Powell, & Christenson, 1985). Exercise is considered a type of physical activity that is planned or structured and often times repetitive, aimed at the improvement or maintenance of physical fitness. Physical activity includes occupational, recreational, household, or other activities and is not necessarily performed with the goal of physical fitness in mind; however both physical activity and exercise may burn calories.

The energy expended in physical activity is often described in terms of kilocalories (or calories) and is a direct outcome of the frequency (times per week), duration (length of particular activity), and intensity (briskness of the activity) of bodily movement regardless of the setting (President's Council on Physical Fitness and Sports, 2003). A Compendium of Physical Activities was developed by Dr. William Haskell to provide standards in coding the intensity of physical activities used to compute energy expended in physical activity settings. There are 21 categories of specific activities grouped together according to the type of physical activity and intensity level for each group. Metabolic equivalent (MET) is a term used in the Compendium of Physical Activities to reflect the intensity of the specific activities. The ratio of the associated metabolic rate for a specific activity divided by the resting metabolic rate is defined as a MET. The energy cost of sitting quietly is equivalent to 1 MET with multiples of 1 MET representing a higher energy cost for a specific activity. Kilocalorie energy expenditure at rest is equivalent to 1 MET per kilogram (kg) body weight per hour so that for a 50 kilogram individual who sits and watches television for one hour has expended 50 kilocalories (1 MET x 1 hour x 50 kg body weight). Kilocalories expended per week doing specific activities can be computed using the formula (Kcal per week = METs x sessions per week x hours per session x body weight in kg).

In 1996, the Surgeon General set forth recommendations about physical activity and health suggesting that all adults expend at least 1000 kilocalories per week in moderate and/or vigorous intensity physical activities. Moderate intensity physical activities increase the body's resting metabolic rate by 3 to 6 METs, enough to increase one's heart rate and depth and frequency of breathing without restricting the ability to have a conversation during the physical activity event. Vigorous intensity physical activities increase the body's resting metabolic rate to greater than 6 METs maximizing one's heart rate, depth and frequency of breathing and limiting the ability to carry on a conversation during the physical activity event. The Compendium of Physical Activities can be used as a guide to identify appropriate intensity physical activities to improve one's health and fitness and has been found useful in providing examples of a range of intensity levels for use in research questionnaires. Moderate intensity activities include examples such as brisk walking, bicycling, hiking, yard work, vacuuming a carpet, or dancing. Examples of vigorous intensity activities include jogging, brisk bicycling, skiing, shoveling snow, tennis, or swimming laps (American College of Sports Medicine, 1995, Pate et al., 1995). Participation in moderate intense activities such as 30 minutes of brisk walking five or more days a week and/or more strenuous vigorous activities such as 15 to 20 minutes of jogging three or more times a week have been shown to be effective in the prevention and treatment of a variety of medical conditions, including breast cancer (USDHHS, 1996; USDHHS, 2007).

The President's Council on Physical Fitness and Sports recommends that women of all ages can benefit from a moderate amount of physical activity, preferably daily (2005). Even though women tend to report less physical activity with increasing age, it is never too late to begin physical activity (American Institute for Cancer Research, 2004). Women over 50 can begin a physical activity program as long as their physician is consulted first to be sure there are no underlying medical conditions or health problems. Previously sedentary women can begin with short 5 to 10 minute intervals of physical activity and gradually work up to their desired level of activity until they reach the current recommended guidelines for breast cancer prevention. Picking activities that are suited to one's weekly routine, interest, and fitness level has been shown to be helpful when initially starting out (American Institute for Cancer Research, 2004). Moderate activities such as walking, gardening, and yard work have been shown to be the most popular leisure-time physical activities among adults, although for some, structured physical activity such as cycling, dancing, swimming, and aerobics may be more enjoyable (USDHHS, 1996). Exercise has been shown to become easier over time, but it may take up to six months to adjust to a new routine. Current core recommendations set forth by the President's Council on Physical Fitness and Sports (2005) and the American College of Sports Medicine (2007) include 30 minutes or more a day of moderate activity five or more days a week and/or 15 to 20 minutes a day of vigorous activity at least three days a week. The physical activity does not need to be done continuously, but can be combined to add up to 15 minutes of vigorous or 30 minutes of moderate activity daily. By maintaining a healthy body weight and regular physical activity, the risk of breast cancer can be significantly reduced (American Cancer Society, 2007; USDHHS, 2007).

Exercise Motivation and Theory

Motivating individuals to be physically active can be very challenging. Data from the 2000 National Health Survey indicate that 72% of women do not engage in regular physical activity (Lee, 2003*)*. More than 60% of women in the United States do not participate in physical activity as recommended by The President's Council of Physical Fitness and Sports and more than 25% are not active at all (USDHHS, 1996). Attrition rates have been shown to be as high as 50% within the first six months of exercise initiation (Dishman, 1982).

Motivation and exercise in women has been studied within the context of several theoretical frameworks in an attempt to identify what factors are most predictive of initiation and adherence to exercise and plan appropriate interventions to increase a woman's participation in physical activity (Wood, 2008). The following theoretical frameworks will be discussed with regards to motivation and exercise: the health promotion model, self-determination theory, social cognitive theory, the health belief model, health action process approach model, transtheoretical model, theory of planned behavior, and the protection motivation theory.

Health Promotion Model

In Pender's health promotion model (HPM), health promotion is directed toward behaviors that maintain and optimize an individual's sense of well-being, personal fulfillment, and self-actualization (Pender, 1996). Pender's 1987 model recognizes five modifying factors (demographic characteristics, biological characteristics, interpersonal influences, situational factors, and behavioral factors) that directly impact seven cognitive-perceptual factors (importance of health, perceived control of health, perceived self-efficacy, definition of health, perceived health status, perceived benefits of health-promoting behaviors, and perceived barriers to health-promoting behaviors) influencing the likelihood of an individual engaging in health-promoting behaviors. Internal and external action cues promote participation in health behaviors. Those individuals who possess internal locus of control are more likely to participate in health promoting behaviors than those individuals with external locus of control, secondary to their perceived ability to exert control over the situation. Albert Bandura's (1986) social cognitive theory is central to the Health Promotion Model; perceived self-efficacy increases the likelihood of an individual engaging in health promoting behavior in order to promote a sense of well-being and self-actualization.

Model Application

Pender's health promotion model has been used most often to study exercise participation within the employee setting. Pender (1996) studied the frequency of exercise among white-collar workers, suggesting a positive correlation between increased activity and optimal well-being. Wellness programs were shown to be beneficial to employees in improving their overall health in those who participated in 12 months of either structured or nonstructured exercise ($p < 0.05$), suggesting that exercise can be beneficial, regardless of the type of exercise program (Elberson, Daniels, & Miller, 2001). The model has been shown to be useful in predicting health promoting lifestyles and instilling a sense of well-being for employees in the workplace (Pender, Walker, Sechrist, & Frank-Stromborg, 1990).

Self-Determination Theory

According to the self-determination theory (SDT), individuals possess three basic needs (autonomy, competence, and relatedness); all three must be satisfied within a social context in order to facilitate motivation, performance, and well-being (Deci &Ryan, 1985). Within this model, there are three types of motivation consisting of amotivation, extrinsic motivation, and intrinsic motivation. These three types of motivation exist along a continuum whereby self-determination guides an individual from amotivation to intrinsic motivation. By definition, amotivation is an individual's lack of intention towards a behavior; extrinsic motivation is the performance of an activity in order to attain an outcome; and intrinsic motivation is activity participation simply to attain pure enjoyment from the activity. Individuals who are intrinsically motivated engage in activities that are interesting, stimulating, and challenging. As an individual moves towards intrinsic motivation, he or she possesses stronger feelings of personal achievement, autonomy, and self-confidence, and gains a sense of well-being. Facilitating intrinsic motivation to promote well-being is considered the critical factor in promoting exercise adherence (Ryan & Deci, 2000).

Model Application

The theoretical framework of self-determination has been primarily used to study exercise motivation among sports enthusiasts. Motives to exercise were compared between 40 Tae Kwon Do and aerobic participants in an attempt to learn more about exercise adherence. Tae Kwon Do participants scored higher on enjoyment and competence as compared to aerobic participants who scored higher on fitness and/or appearance. Tae Kwon Do participants showed better long-term adherence to exercise than aerobic participants ($p < .001$). Physical activity that focuses on enjoyment, competence, and social interaction has been shown to facilitate long-term exercise adherence (Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997). In order to facilitate exercise motivation it is critical to choose an activity that is intrinsically motivating and vigorous enough to promote health and well-being (Iso-Ahola & St. Clair, 2000).

Unfortunately, when women perceive a lack of control, competence, or relatedness to social roles or relationships, as in marital or parental obligations, and are unable to internalize motivation, they are less likely to participate in physical activity (Landry & Solmon, 2002).

Social Cognitive Theory

The social cognitive theory (SCT) is based upon an individual's perception of his or her skills and abilities to effectively and competently perform a specific behavior to achieve an expected outcome (Bandura, 1986). An individual make assumptions about the possible consequences or outcomes of a behavior before taking action, and believes in one's ability to perform a specific behavior to attain a desirable outcome (Bandura, 1977, 1982).

Bandura (1977, 1982) suggests that self-efficacy is a central construct in this theory, positively driven by motivation and extensively controlled by behavioral intention and outcome expectancies. Self-efficacy is based upon an individual's confidence to act effectively and competently in performing a specific behavior (Bandura, 1986). Task self-efficacy, the belief in being capable of performing a particular action, and coping self-efficacy, the belief in one's ability to perform this task in spite of environmental demands and obstacles, enables an individual to achieve a desired goal (Rodgers, Munroe, & Hall, 2002). According to Bandura (1977, 1986), self-efficacy expectations are derived from several factors including: performance accomplishment (mastery of a previous task); vicarious experiences (participation modeling); verbal persuasion (positive feedback); emotional arousal (emotional control techniques through relaxation, biofeedback and desensitization); physiological state (readiness to rise to the occasion);

and imaginable experiences (envisioning your success). Efficacy expectations help to explain how much effort individuals will exert and how long they will persist to achieve a specific outcome in spite of obstacles or barriers (Bandura, 1982). Those individuals who are confident about their abilities to reach a particular goal are more highly motivated and much more likely to engage in physical activity (Dishman & Buckworth, 2001).

Model Application

The social cognitive theory has been extensively used to predict exercise behavior in a variety of therapeutic settings. Within a vigorous physical education skills class, self-efficacy was the strongest predictor of exercise behavior among male and female undergraduate students. Students who felt more confident about their abilities to exercise, in spite of barriers to participation, exercised more days per week than those who felt less confident (Dzewaltowski, 1989). Among African American and White females, ages 50 to 80 years, accurate exercise knowledge was shown to enhance self-efficacy in the adoption and maintenance of regular exercise. Time constraints were considered a barrier to exercise, regardless of the acknowledged benefits of exercise (Fitzgerald, Singleton, Neale, Prasad, & Hess, 1994). Among male and female adult participants, aged 18 to 78, age was deemed to be the best predictor of self-efficacy in relation to physical activity, suggesting a positive correlation between physical activity, level of education and self-efficacy, especially among the male participants (Netz & Raviv, 2004). While physical activity during breast cancer treatment was shown to be helpful in reducing treatment related fatigue and improving the quality of life for a focus group of women, the majority of women expressed the desire to receive exercise counseling, suggesting the need for further research to explore other potential benefits of exercise and plan appropriate interventions (Rogers et al., 2004).

Health Belief Model

According to the health belief model (HBM), health behaviors are determined by an individual's perception of a threat posed by a health problem and the value of a behavior taken in reducing this threat, weighed against the perceived benefits and/or barriers of taking action (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977; Rosenstock, 1974). Both internal and external cues to action drive the individual's choices of health behaviors. An individual must believe in the value of a behavior taken in reducing the threat and the efficacy of the behavior in affecting the outcome. In 1988, Rosenstock, Strecher, and Becker proposed that self-efficacy be incorporated into the model as a supplementary component (Rosenstock, Strecher, and Becker, 1988).

Model Application

The health belief model has been applied to smoking and alcohol addiction, contraceptive use, dental behaviors, medication and dietary compliance in diabetes and hypertension (Becker et al., 1977; Sheeran & Abraham, 1996). The model has also been used to explore common factors that influence women to comply with current mammography screening guidelines (Vienot & Manderachia, 2004). Health care provider recommendations for mammography along with education about the risks and benefits of screening were shown to significantly increase mammography compliance ($p = 0.05$) among 179 female participants. Lack of knowledge about recommendations and risk factors were identified as barriers to mammography screening. The health belief model has also been shown to be helpful in predicting gene testing for breast cancer (Cappelli et al., 2001). Perceptions of increased personal risk, greater perceived benefits, and fewer perceived costs were associated with greater interest in gene testing among a group of 193 female participants ($p < 0.05$). Women were more likely to consider gene testing when they perceived themselves to be at higher risk of developing breast cancer as compared to the general population group. The original health belief model has had limited application with regards to motivation and exercise; the addition of self-efficacy into the health belief model has since improved its applicability (Janz & Becker, 1984; Landry & Solmon, 2002). In a study by Girvin & Reese (1990), perceived barriers accounted for 22% of the variance among 159 health education teachers in a university setting, 72% of which were females, and were determined to be the most powerful predictor of participation among exercisers versus nonexercisers. Motivation contributed another 2% to the variance between the two groups and both factors were shown to be significant ($p < 0.05$). Corwyn & Benda (1999) showed perceived benefits of exercise to be the strongest predictor of exercise, and modeling others who regularly engage in exercise, the second strongest predictor of exercise, accounting for 41.8% of the total variance among men and women between the ages of 18 and 60. Health information and advice related to exercise were also shown to predict exercise behavior, suggesting that health care support can play a major role in exercise motivation.

Health Action Process Approach Model

The health action process approach model consists of two stages, a motivation phase and a volition or action phase; these two stages account for the adoption, initiation, and maintenance of health behaviors (Schwarzer, 1992; 2001). Behavioral intentions, perceived self-efficacy, and outcome expectancies from a self-regulation process are the essential components of this model. In the motivation phase, an individual forms an intention to change based upon perceived vulnerability and perceived severity of a threat, as well as outcome expectancies and self-efficacy. In the volitional phase, individuals plan out details of which actions to take, act upon the details, and maintain behavior changes in the face of obstacles and failures. Once an action is undertaken, a cognitive or self-regulatory process allows the behavior to be maintained. This self-regulatory process keeps other distracting motivators at bay until the behavior becomes habitual.

Model Application

The HAPA model has been used to explore the relationship between self-efficacy, outcome expectancies, and risk perceptions in predicting health related behaviors (Schwarzer & Fuchs, 1996). Self-efficacy towards health eating behavior was assessed in 800 male and female participants, aged 18 to 70 years, with results suggesting that self-efficacy beliefs, especially among women, are necessary to predict behavioral intentions (0.58) and corresponding actions (0.50). Behavioral intentions among female undergraduate students regarding dieting and performance of self-breast exam were measured within the context of several cognitive models, including the health action process model (Garcia & Mann, 2003) and the HAPA model was found to be the best predictor of behavioral intentions ($p < 0.001$). Similar results were found among a sample of 418 college students, 18 to 49 years of age, who responded to a questionnaire regarding their intentions to perform self-breast examination (Luszczynska & Schwarzer, 2003). Risk perception, outcome expectancies, and self-efficacy were measured and while behavioral intention was well predicted by outcome expectancies and preaction self-efficacy, risk perception was unrelated to the other constructs ($p < 0.05$). Application of this model with regards to exercise intentions and behavior is limited, mostly to the realm of physical rehabilitation. Planning, self-efficacy, and action control were shown to bridge the gap between intentions and the maintenance of physical activity among cardiac rehabilitation patients (Sniehotta, Scholz, & Schwarzer, 2005) who were encouraged to engage in regular exercise over a four-month period ($p < 0.01$). There were similar findings among cardiac and orthopedic rehabilitation participants over a period of 4 to 12 months ($p < 0.01$), suggesting that action planning and self-efficacy were effective predictors of physical activity adherence, but not health risk perception (Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008).

Transtheoretical Model

The transtheoretical model (TTM) evaluates an individual's motivational readiness to progress through five stages of change in the process of acquiring and adopting a new behavior, such as exercise (Prochaska, Diclemente, & Norcross, 1992). The TTM, otherwise known as the stages of change model, includes the following five behavioral stages: precontemplation, contemplation, preparation, action, and maintenance. In precontemplation, an individual is not thinking about changing the behavior, while in the contemplation stage, an individual has given some thought to changing the behavior, but is not yet committed. When an individual moves into the preparation stage, he or she has made a commitment to behavioral change and begins to prepare for these changes. In the action stage, an individual is actively engaged in behavioral change. And finally in the maintenance stage, an individual has learned to sustain the change over a period of at least six months.

Model Application

The transtheoretical model has been extensively used to study exercise adherence in within the health care setting. The transtheoretical model was used to predict exercise behavior among a group of women between the ages of 59 to 78 years, diagnosed with low bone density, over the course of 12 months (Litt, Kleppinger, & Judge, 2002). Self-efficacy, readiness for change, and social support were found to be significant predictors of exercise behavior ($p < 0.05$) within the stages of change model. Among a group of 30 cardiac and pulmonary rehabilitation program participants, self-efficacy was found to be the best predictor of exercise adherence over a 12 to 18 week period (Guillot, Kilpatrick, Hebert, & Hollander, 2004). In a study involving 425 female and male participants who regularly engaged in leisure time exercise 2 to 3 times per week, extrinsic motives were shown to dominate during the early stages of change, and intrinsic changes became more important in the later stages of change ($p < 0.05$), primarily during the maintenance stage of physical activity (Ingledew, Markland, & Medley, 1998). In spite of its widespread application to exercise research, the transtheoretical model has been criticized for its inability to measure specific changes within each stage to adequately predict exercise behavior (Renner & Schwarzer, 2003).

Theory of Planned Behavior

The theory of planned behavior (TPB), assumes that health behavior is determined by behavioral intention (Ajzen, 1988; Fishbein & Ajzen, 1975). Accordingly, there are three conceptually independent determinants of behavioral intention: attitude, subjective norm, and perceived behavioral control. Attitude is reflected in the individual's perceived evaluation, either positive or negative, of performing the behavior.

Subjective norm reflects the perceived social pressure that an individual feels in deciding whether or not to perform the behavior. Perceived behavioral control reflects the individual's perceived confidence in his or her ability to perform the behavior, considering both resources and opportunities, and the likelihood for success. Individuals are more likely to engage in physical activity if a positive attitude is assumed, have social pressure to do so, and believe in their successful execution of the behavior (Armitage, 2005). Behavioral intentions to exercise are based on fitness attitudes or one's ability to try, while exercise behavior is defined by an individual's perceived behavioral control, both of which ultimately control exercise behavior (Kerner, Grossman, & Kurrant, 2001).

Model Application

The theory of planned behavior has been shown to explain and predict health-related behaviors and has been widely used in exercise research. In a meta-analysis (Godin & Kok, 1996), the theory of planned behavior accounted for 41% of the variance in behavioral intentions and 34% of the variance in health behavior such as exercise. In Blue's (1995) integrative review, attitude was seen as the best predictor of behavioral intention, suggesting that individuals are more likely to exercise when they possess a positive attitude towards exercise. Likewise, in Hagger, Chatzisarantis, and Biddle's meta-analysis (2002), a positive attitude was shown to the strongest predictor of physical activity intentions. It would seem that persuasive messages targeting salient beliefs are more likely to produce positive attitudes ($p < .05$) and stronger intentions ($p = .05$) towards healthy behaviors among individuals than messages targeting nonsalient behavioral beliefs, suggesting that attitudes can influence behavioral intentions (Chatzisarantis & Hagger, 2005).

Protection Motivation Theory

The protection motivation theory (PMT) suggests that two processes (threat appraisal and coping appraisal) predict protection motivation, and is reflected in an individual's intention to perform a recommended protective health behavior (Rogers, 1983). Threat appraisal comprises both perceptions of vulnerability and the severity of a disease. Coping appraisal refers to perceptions of response efficacy and self-efficacy. An individual's perception of developing a health condition (vulnerability), and the individual's belief in the disabling consequences imposed by the health condition (severity), along with fear arousal (potential for harm), are significant enough to motivate behavioral change. Response efficacy supports the belief that the behavior undertaken by the individual will alleviate or reduce the threat associated with the health condition, while self-efficacy allows the individual to believe that the behavior undertaken can be successfully performed.

Threat appraisal determines the likelihood of a maladaptive response while coping appraisal determines the likelihood of an adaptive response. The perception of threat (increased severity and vulnerability) decreases the likelihood of the maladaptive response while intrinsic rewards (e.g., physical and psychological pleasure) and extrinsic rewards (e.g., peer approval and social norms) increase the likelihood of the maladaptive response (Maddux, 1993). The adaptive response of coping appraisal (response efficacy, self-efficacy, and response costs) suggests that as response efficacy and self-efficacy increase, so does the likelihood of engaging in the recommended health behavior, unless the perceived costs (e.g., inconvenience, difficulty of the task, personal time, and effort) outweigh the benefits (Maddux, 1993; Rogers & Prentice-Dunn, 1997). The two cognitive mediating processes (threat and coping appraisal) mediate the persuasive effects of a fear appeal by eliciting protection motivation, which is reflected in an individual's intention to perform a recommended protective health behavior, such as exercise. (Rippetoe & Rogers, 1987).

Model Application

Protection motivation theory has been used as a framework to predict and influence health related behaviors such as smoking cessation, AIDS prevention, cancer prevention, alcohol consumption, environmental protection, and bicycle safety, as well as exercise and lifestyle change (Floyd, Prentice-Dunn, & Rogers, 2000). Within the realm of exercise and lifestyle change, Stanley and Maddux (1986) tested the four components of protection motivation theory (severity, vulnerability, response efficacy, and self-efficacy). Undergraduate students were provided written persuasive messages aimed at promoting exercise behavior, demonstrating that response efficacy was the single best predictor of exercise intention ($R^2 = 0.26$) and self-efficacy a strong second predictor of exercise intention ($R^2 = 0.17$). Likewise, Wurtle and Maddux (1987) provided undergraduate women with written persuasive appeals for increasing exercise among nonexercisers (i.e., exercise < 3 days per week). Both vulnerability and self-efficacy were shown to enhance exercise intentions ($p < .05$). In a similar study, Milne, Orbell, and Sheeran (2002) attempted to promote exercise participation among undergraduate students (73% women) using motivational interventions aimed at health education teaching. Motivational interventions designed to affect response efficacy had the greatest impact on exercise adherence ($p < .001$). Unfortunately, studies are limited with regards to exercise and cancer prevention. In one such study, Courneya and Hellsten (2001) demonstrated that cancer prevention strategies and teaching can motivate individuals to exercise. Undergraduate students who were led to believe that colon cancer was a severe disease were more likely to exercise if they thought in doing so that it would reduce their risk for developing colon cancer. Perceived severity and response efficacy were positively correlated with exercise motivation ($p \leq .01$), suggesting that cancer prevention can be an exercise motivator, although further research is needed to replicate and generalize these findings.

Breast Cancer Risk Perception

Nursing literature often uses susceptibility or vulnerability interchangeably with risk (Lee, 2003). Susceptibility is used as a means to identify an individual's perceived risk of harm (Spiers, 2000). Susceptibility is an individual's perception and likelihood of being harmed for which that individual perceives some control over the situation and the outcome (Rogers & Prentice-Dunn, 1997; Vienot & Manderachia, 2004). The degree of susceptibility is dependent upon the perception of the individual. Perceptions of susceptibility can range from complete denial to imminent harm (Finfgeld, Wongvatunyu, Conn, Grando, & Russell, 2003).

In healthcare, susceptibility or perceived risk are concepts employed to predict behavior adherence. The person must feel susceptible to a problem in order to affect behavior (Poss, 2001). Perceived susceptibility to a health condition will drive the person's choices of health-related behaviors (Petro-Nustas, 2002). An individual's perceived susceptibility to a health problem and the value of a behavior undertaken by the individual to decrease susceptibility will positively influence health outcomes for that individual (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977; DiMatteo et al., 1993; Given & Given, 1989). Provider discussions about family history and personal risk have been shown to increase patient adherence to health related behaviors (Royak-Schaler et al., 2002). A woman who perceives that she is susceptible to breast cancer is more likely to participate and adhere to health-related behaviors in order to reduce her risk of developing the disease (Helmes, 2002; Marteau & Lerman, 2001; Prentice-Dunn, Floyd, & Flournoy, 2001; Rippetoe & Rogers, 1987).

Perceived risk is a central concept within many theoretical models used to explain and predict health behavior (Becker**,** Maiman, Kirscht, Haefner, & Drachman, 1977; Fishbein & Ajzen, 1975; Rogers, 1975; Schwarzer, 1992)**.** Not until individuals perceive their own personal risk from a health threat do they have reason to consider modifying behaviors to reduce risk (Courneya & Hellsten, 2001; Janz & Becker, 1984; Landry & Solmon, 2002; Rippetoe & Rogers, 1987; Skinner, Kreuter, Kobrin, & Strecher, 1998). With regards to breast cancer, in order to effect a behavioral lifestyle change, a woman must believe in the severity of breast cancer and its associated morbidity and/or mortality as well as in her own personal risk of developing the disease within the near future. She must also believe in the value of a behavior taken in reducing the threat and the efficacy of the behavior in affecting the overall outcome.

The Gail model (Gail et al., 1989) has been widely used in research and clinical practice to determine breast cancer susceptibility and perceived risk. The Gail model assesses 5-year and lifetime breast cancer risk based on the observable indicators of susceptibility. According to the Gail model, a woman is considered to be at high risk if she has a Gail model score of at least a 1.67% and at average risk if she has a Gail model score of less than a 1.67%. The Gail model has been used in research to help guide decision-making and health behavior (Quillin, Fries, McClish, Shaw deParedes, & Bodurtha, 2004).

Observable indicators of susceptibility (used in the Gail model) include such risk factors as age, family history, early menarche, nulliparity or late first birth after the age of 30, number of previous atypical biopsies, race, and late menopause (American Cancer Society, 2007; Brewster & Helzlsouer, 2001; Key, Verkasalo, & Banks, 2001; Vogel, 2000). As women age, their risk of invasive breast cancer significantly increases. About 17% of women with invasive breast cancer are diagnosed in their 40s and over 78% are 50 years or older (American Cancer Society, 2006). Family history, especially a first-degree relative, increases breast cancer risk, as does inherited mutations or alterations in the breast cancer susceptibility genes, BRCA1 and BRCA2 (National Cancer Institute, 2007). Early menarche (before the age of 12 years) or late menopause (after the age of 55 years), as well as no pregnancy or first pregnancy after 30 years can increase breast cancer risk by affecting hormone production in the body. Caucasian women have a higher incidence of breast cancer, although African American women are more likely to die of breast cancer. These differences have been attributed to later stage at diagnosis and more aggressive disease among African American women. Hispanic, Asian, and Native American women seem to have both a lower incidence and mortality rate of breast cancer, for unknown reasons. Atypical biopsies, including atypical ductal hyperplasia and/or atypical lobular hyperplasia, can increase breast cancer risk 4 to 5 times higher than the average woman or 8 to 9 times higher with a family history of breast cancer

(American Cancer Society, 2006). By examining the more commonly known risk factors, a woman's susceptibility to breast cancer can be easily ascertained, thus identifying those individuals who would be considered at high risk of developing the disease.

While the Gail model has been effectively used in clinical practice to measure objective risk, investigations of breast cancer risk perceptions suggest that women consistently overestimate their objective risk (Haas et al., 2005; Lipkus, Klein, & Rimer, 2001; Quillin et al., 2004; Skinner, Kreuter, Kobrin, & Strecher, 1998). Women typically overestimate their own lifetime breast cancer risk by at least 15% above their Gail model estimate (Buxton, Bottorff, Balneaves, Richardson, et al., 2003). Biased perceptions of personal breast cancer risk can cause a woman to either over or underestimate her personal risk, significantly effecting cancer prevention behaviors (Bottorff et al., 2004; Facione, 2002). The tendency to overestimate risk seems to decrease with more education (Skinner et al., 1998). Women who believe they can control their own health through behavioral interventions are more likely to report a lower risk perception than women who believe that chance or others control their health outlook (Rowe, Montgomery, Duberstein, & Bovbjerg, 2005). Objective (actual) risk as computed by the Gail model and subjective (perceived susceptibility) risk may be two very different concepts, each having its own unique influence on health behaviors. Whether subjective risk needs to match objective risk estimates to be an effective strategy for cancer prevention and control is yet to be determined (Audrain-McGovern, Hughes, & Patterson, 2003; Bottorff et al; Leventhal, Kelly, & Leventhal, 1999; Quillin et al.).

Providing women with accurate information about their risk with appropriate counseling by a trained nurse educator has been shown to improve their risk comprehension (Lerman et al, 1995). Women with a family history of breast cancer view their risk of developing breast cancer as higher and are more likely to engage in health prevention behavior such as screening (Hailey, Carter, & Burnett, 2000). Increasing breast cancer risk perception has been shown to lead to fear about the disease, triggering protection motivation and the desire for genetic testing for breast cancer risk (Helmes, 2002). It is vital for a woman to understand her breast cancer risk so as to enable her to make educated decisions regarding preventative action in such matters as genetic testing, screening, and/or exercise (Eibner, Barth, & Bengel, 2006; Lipkus, Biradavolu, Fenn, Keller, & Rimer, 2001). Hopefully, by tailoring interventions to accurate risk assessments, women will respond accordingly, thus promoting exercise participation to reduce breast cancer risk (Skinner, Campbell, Rimer, Curry, & Prochaska., 1999).

Self-Efficacy

According to Bandura (1982), self-efficacy is the confidence in one's ability to perform a particular task. An individual should be able to effectively execute a particular task in spite of any obstacles or barriers. Self-efficacy is positively related to motivation and extensively regulated by behavioral intention and planning. Outcome expectancies on performance motivation are based upon personal self-efficacy beliefs, as an individual makes assumptions about the possible consequences or outcomes of behaviors before taking action, based on one's belief in being capable of performing a specific behavior to produce a desirable outcome (Bandura, 1977, 1982).

Perceived self-efficacy appears to be the most common factor in increasing the likelihood of commitment to action and performance of exercise behavior and has been noted as a central construct in many theoretical frameworks (Bandura, 1986; Dishman &

Buckworth, 2001; Dzewaltowski, 1989; Guillot et al., 2004; Schwarzer and Fuch, 1995). Because of its importance in promoting health behavior, self-efficacy expectancy was added to the revised model of protection motivation theory (Bandura, 1977; Maddux & Rogers, 1983; Rogers, 1983). Self-efficacy has been shown to be the most powerful predictor of exercise intentions (Wurtele & Maddux, 1987) and thought to be an important determinant in the early stages of exercise before the behavior becomes habitual (McAuley, 1992). Continued participation in physical activity among adults has been shown to be dependent upon one's ability to effectively participate in physical activity, enjoyment of physical activity, support from others, positive benefits of physical activity, and lack of perceived barriers (USDHHS, 1996).

Manipulating self-efficacy has been shown to enhance exercise participation, especially among women (McAuley, Talbot, & Martinez, 1999). Health information and accurate exercise knowledge has been shown to enhance self-efficacy in the adoption and maintenance of regular exercise (Corwyn et al., 1999; Fitzgerald et al., 1994; Netz et al., 2004). Highly educated women are much more likely to participate in physical activity than those with a high school education or less. However, this may be due to a lack of knowledge of health care benefits and/or the level of physical activity required in attaining such health-related benefits (Audrain, Schwartz, Herrera, Goldman, & Bush, 2001; USDHHS, 1996). It appears that women are more likely to exercise if given specific instructions about the type of exercise needed to achieve the desired results (Speck, 2002; Wilbur, Miller, Montgomery, & Chandler, 1998). Nurses are in a unique position to educate women about the benefits of physical activity, suggesting that interventions should be designed to assist women in achieving greater levels of self-efficacy to promote participation (Stutts, 2002). Health care providers can be instrumental in promoting physical activity, as patients respect their advice and often change behavior because of it (Lewis & Lynch, 1993).

Efforts to improve self-efficacy include performance mastery, modeling, positive reinforcement, and emotional arousal (Bandura, 1977, 1982). Individuals need proper instruction and learn through personal experience and performance mastery. Modeling others to successfully learn how to perform an exercise task can be very helpful. Individuals need positive feedback to enhance self-efficacy and promote exercise behavior. And most important, individuals need education and emotional arousal regarding the benefits of exercise in order to promote good health and reduce the health risks associated with a sedentary lifestyle (McAuley & Blissmer, 2000).

Chapter 2 reviewed the literature regarding physical activity and breast cancer risk reduction. Physical activity, adiposity and weight gain were discussed in relationship to breast cancer risk. Exercise motivation was reviewed within the context of several theoretical frameworks, and the significance of risk perception and self-efficacy were discussed with regards to exercise behavior.

CHAPTER 3

METHODS

The purpose of this chapter is to describe the study's methods and procedures. The study's design, conceptual and operational definitions, participants, setting, measures, research procedure, data collection and analysis, and strengths and limitations will be presented.

Purpose and Specific Aims

The overall purpose of this study was to determine whether risk and/or health information and accurate exercise knowledge could motivate a woman to exercise and to gain a deeper understanding of how risk perception impacts exercise behavior. The specific aims and/or objectives were to (a) determine whether a woman's risk of developing breast cancer based on her Gail model score can motivate her to participate in regular physical activity in order to reduce her risk of developing the disease, (b) determine whether general health information versus specific health and exercise information can predict participation in regular physical activity, especially in woman who are at higher risk of developing breast cancer, (c) explore the accuracy of a woman's perception of breast cancer risk in relationship to her Gail model score, and (d) test the main framework of protection motivation theory within a healthcare setting.

The following hypotheses were tested in this study:

1. A woman who is at higher risk of developing breast cancer is more likely to participate in regular physical activity (≥ 3 times/week) than a woman at average risk of developing breast cancer.

2. A woman who receives specific written health and exercise knowledge information is more likely to participate in regular physical activity (≥ 3 times/week) than a woman who receives general written health information only.
3. Breast cancer risk perceptions need to match objective breast cancer risk estimates to be an effective tool in predicting exercise behavior in women.

Research Design

An experimental, randomized block design was used to predict exercise behavior among women in a clinical setting over the course of a three month period based upon three predictor variables, actual risk, perceived risk, and self-efficacy in order to test the theory of protection motivation (Rogers, 1983). Three months represented a realistic and feasible time frame in which to capture health related behavioral changes such as exercise behavior (Marcus, Selby, Niaura, & Rossi, 1992). In a randomized block design there are at least two independent variables, one of which cannot be experimentally manipulated, known as the blocking variable (Burns & Grove, 2005; Polit & Beck, 2004). Since risk could not be ethically manipulated, women were blocked by Gail risk into one of two groups: high risk or average risk. The inclusion of a blocking variable in this study was necessary to ensure a sufficient number of high and average risk participants for comparison (Polit & Beck, 2004).

After block randomization, each participant was randomly assigned to one of two treatments: control (general written health information) or experimental (specific written health and exercise knowledge information) to determine which treatment was more effective in motivating women (high risk versus average risk) to exercise over the course of a three month period (see Figure 3).

Setting

This study took place in the Breast Care Center/Mammography outpatient department at St. Luke's Hospital. The facility was open from 8:00 in the morning until 5:00 in the evening each day, Monday through Friday. The facility was divided into two departments, the Breast Care Center for physician appointments, and Mammography for scheduled mammograms and ultrasound imaging studies. There were three separate waiting rooms: the general waiting room, the Breast Care Center waiting room, and the Mammography waiting room. As a woman entered the general waiting room she signed in with the front receptionist. The receptionist then directed her to the Breast Care Center, if she had a physician appointment, or had her take a seat in the general waiting room, if she was there for imaging. If there for imaging, she would wait until called to be registered and afterwards taken to the Mammography waiting room. If a woman was scheduled for services in the Breast Care Center she was registered with the receptionist in the Breast Care Center and then seated in their waiting room. The researcher's private office, in the Breast Care Center, adjacent to its waiting room, was equipped with a computer, two desks, and three chairs. This private office was used for study enrollment and data collection, allowing only the participant and primary investigator to be in this room while data were collected. Either the receptionist in the general waiting room or the Breast Care Center directed interested participants to the researcher's office.

Figure 3. Posttest experimental randomized block design with two comparison treatments.

Block randomization (high or average risk) → Treatment #1 or #2 → Posttest

Treatment #1 (control) = general written health information

Treatment #2 (experimental) = specific written health and exercise information

Sample

A convenience sample of women, aged 40 to 65 years old, was chosen to reflect an adequate representation of middle-aged women in the population who receive annual mammography screening and clinical breast examination. The American Cancer Society currently recommends that women 40 years and older obtain annual screening mammography. Women younger than age 40 or older than 65 were excluded since women younger than 40 do not typically receive yearly mammograms and women older than 65 usually require close monitoring due to the increased health risks associated with exercise and aging.

Participant accrual took place on Monday (all day), Tuesday and Wednesday (mornings), and Friday (afternoons). Flyers with enrollment information (Appendix A) were set out on tables in all three waiting rooms (the general waiting room, the Breast Care Center waiting room, and the Mammography waiting room) on the above days and only during these hours so as not to interfere with the researcher's ability to act as a health care provider during office hours in the Breast Care Center. Any woman unable to enroll during these hours was also given the option of calling the researcher to schedule an appointment at a mutually convenient time. Additional flyers were distributed to physicians' offices at St. Luke's Hospital and posted at various locations throughout St. Luke's Hospital with their permission. Flyers were also distributed at two different St. Luke's women wellness events, which took place during the course of the study. An average of about 100 women received services daily in Mammography Monday through Friday and an additional 25 women received services in the Breast Care Center daily Tuesday through Friday. Participant accrual was estimated to take about four months.

Eligibility Criteria

Each participant needed to able to read and understand English in order to complete the questionnaires. Any woman, ages 40 to 65, who registered in the Breast Care Center /Mammography facility and was free of any chronic medical or physical limitations that would prohibit her from exercising, and was not currently participating in any form of regular physical activity > 2 times per week was allowed to participate in the study.

Exclusion Criteria

A woman was excluded if she had a present and/or past history of breast cancer as the Gail model is not designed to calculate risks for women who have been already diagnosed with breast cancer. The Zung (1965) self-rating depression scale (Appendix B) was administered to every participant prior to enrollment to determine eligibility. The Zung self-rating depression scale was designed to be used as a screening tool for depression and can be effectively used in a variety of settings, including research trials (Carroll, Fielding, & Blashki, 1973). Each item was scored on a Likert scale from 1 to 4. By summing the 20 individual items, a total score ranging from 20 to 80 was possible. Individuals with depression usually score between 50 and 69 and any score of 70 and above is indicative of severe depression. Any individual scoring ≥ 50 was considered at risk for depression and deemed ineligible for this study and referred to her primary care provider. Women younger than age 40 or older than 65 were excluded since women younger than 40 do not typically receive yearly mammograms and women older than 65 usually require close monitoring due to the increased health risks associated with exercise and aging.

Power Analysis

Procedures for estimating effects and sample sizes vary depending upon the statistical situation within the context of a given study (Cohen, Cohen, West, & Aiken, 2003). Tabachnick and Fidell (2001) recommend using the formula $N \geq 50 + 8m$ (where N is the number of participants and m is the number of independent variables) for multiple regression analysis, which was used to conduct the statistical analyses. Determining the appropriate sample size needed to obtain sufficient power is usually done by performing a power analysis. Parameters chosen in this study reflected the conventional standards used by most nurse researchers and included the following: significance criterion alpha (risk of a Type I error), population effect size (magnitude of the relationship between the research variables), power (risk of a Type II error), and number of predictors (Polit & Beck, 2004). Using G-Power computer software (Faul & Erdfelder, 1992) and the standard respective parameters for alpha (.05), population medium effect size (0.15), power (0.80), and predictors (3), a total of 77 participants were needed to conduct the analyses. Factoring in an approximate 20% anticipated attrition rate into the estimated sample size, a minimum of 92 participants (at least 46 high risk and 46 average risk using a quota sampling method) needed to be recruited (Polit & Beck, 2004). Quota sampling ensured an equal number in each stratum for the planned statistical analysis (Burns & Grove, 2005).

Protection of Human Participants

Women interested in participating were directed to the primary investigator by one of the receptionists in either the general waiting room or Breast Care Center to obtain voluntary written informed consent. As a health care provider in this facility, it was understood that the primary investigator would not be directly involved in any participant's care as her healthcare provider during the course of data collection to prevent any participant or researcher bias. Study participants were informed of the overall research purpose, allowing full disclosure to protect their rights. Essential elements of the informed consent included a description of the study and its purpose; study expectations; potential risks and benefits to the participant; confidentiality and contact information; and provided compensation for participation in the study (Appendix C). The participant's comprehension of consent information was assessed prior to obtaining written consent, allowing whatever time was necessary to address any questions or concerns. The written consent form was signed by the participant and witnessed by the investigator collecting the data and the participant was given a copy of the signed consent form for her records. The researcher will keep the original consent form for three years after completion of the research according to standard guidelines for conducting human research (United States Department of Health & Human Services, 2006).

Participation in the study was strictly voluntary and participants had the right to refuse or withdraw from treatment at any time. Only the researcher was able to match the identity of the individual with the corresponding data so as to protect the confidentiality of all participants. All data were kept in a locked cabinet in the researcher's private office and will be kept by the researcher for three years after study completion. Full Institutional Review Board (IRB) approval was obtained through St. Luke's Hospital and the University of Missouri, St. Louis prior to conducting this study in the Breast Care Center/Mammography facility at St Luke's Hospital.

Participant Compensation

Each participant was given a breast cancer awareness bookmark upon enrollment and mailed a $5 gift card along with the mailed questionnaire packet at the end of the three-month study as a token gesture of appreciation.

Variables and Measurements

Demographic information (Appendix D) was obtained from every woman who enrolled in the study. Demographic information included age, ethnicity, weight and height, marital status, educational level, and job classification that were used to describe the sample in the results and discussion section.

Gail Model

The Gail model (Appendix E) assesses a woman's 5-year and lifetime risk (up to the age of 90) of developing invasive breast cancer by comparing her risk derived from a logistic regression equation based on age, personal and family history, menarche, parity, previous biopsies, and race to a same-age woman without risk factors using an interactive computer tool to calculate a Gail risk score (Gail et al., 1989). The tool was further developed at the National Cancer Institute by Gail and Benichou (1992) and is available on-line at http://www.cancer.gov/bcrisktool. The on-line version consisted of seven questions that had to be answered in order to calculate a Gail risk score. A woman was considered to be at high risk of developing invasive breast cancer if she had a Gail risk score of at least a 1.67% and at average risk of developing invasive breast cancer if she had a Gail risk score of less than a 1.67% over a five-year period.

The application of the goodness to fit to the Gail model (ratio of expected to observed numbers of cases = 0.94, 95% confidence interval = 0.89 to 0. 99) has been shown to accurately predict a woman's five year risk of developing invasive breast cancer of 1.67% or greater (Rockhill, Spiegelman, Byrne, Hunter, & Colditz, 2001). The Gail model is considered an excellent quantitative model and has been used to accurately predict a woman's risk of developing breast cancer over the course of her life and has been used in many studies to improve our understanding of risk perceptions (Buxton et al., 2003; Lipkus, Klein, Skinner, & Rimer, 2005). Women have been shown to benefit from understanding such risk information, helping them to make informed decisions about health care and prevention behavior (Quillin et al., 2004). While the Gail tool has been accurately used to predict breast cancer risk in white women with a strong family history of breast cancer, it has limited application when used to predict breast cancer risk in those women with specific hereditary predispositions, such as the BRCA1 or BRCA2 gene (Gail et al., 1989). Since none of the women were suspected of carrying such a mutated gene, the Gail model was considered an adequate tool for use in this study.

Breast Cancer Susceptibility Subscale

Breast cancer risk perception was measured using Champion's breast cancer susceptibility subscale (1984, 1993, 1995, 1999). This 5-item self-report breast cancer susceptibility subscale (Appendix F) measures a woman's perceived probability of developing breast cancer using a Likert scale of 5 as "strongly agree" and 1 as "strongly disagree." Scale items include such statements, as "I am more likely than the average woman to get breast cancer." A summated score of ≥ 20 indicates higher perceived susceptibility to breast cancer.

Champion's breast cancer susceptibility subscale has been successfully used to measure a woman's perceived risk of developing breast cancer among women with family histories of breast cancer (Lancaster, 2005). Prior evidence of criterion and construct validity was established through multiple regression and factor analysis (Champion 1984, 1993). Exploratory factor analysis indicated that all five items loaded at .84 or above on the factor of susceptibility with a Cronbach alpha of .93 and a test-retest reliability of .70 (Champion, 1993). In the present study the Cronbach alpha coefficient was .92. The tool has demonstrated good content and construct validity and reliability in general populations (Champion, 1999).

Self-Efficacy Questionnaire

The self-efficacy questionnaire (Appendix G) was developed to assess confidence in one's ability to adhere to physical activity (Marcus & Forsyth, 2003; Marcus et al., 1992). The five-item scale measures self-efficacy for physical activity in a variety of situations such as when one feels fatigued or encounters inclement weather. A 5-point Likert scale, ranging from 1 (not at all confident) to 5 (very confident), is used to rate each item, computing the average of all five items to calculate a score. Higher scores indicate greater self-efficacy. The questionnaire was designed to be administered every three months. Ideally, self-efficacy scores should increase as an individual becomes more active.

Internal consistency Cronbach alpha coefficient and test-retest reliability over a 2-week period using the self-efficacy questionnaire have been reported to be .82 and .90 respectively (Marcus et al., 1992). The Cronbach alpha coefficient in the current study was .72. The self-efficacy for exercise questionnaire has been effectively administered in several studies measuring exercise. Self-efficacy has been shown to be the best predictor of exercise adherence in a clinical setting (Guillot et al., 2004). Individuals with high self-efficacy for exercise have more readiness for exercise, and will engage in a greater amount of physical activity than those individuals with low self-efficacy (Gallagher, Jakicic, Napolitano, & Marcus, 2006; Marcus, Eaton, Rossi, & Harlow, 1994). Individually tailored, motivationally matched interventions designed to increase self-efficacy can enhance participation in physical activity (Marcus et al., 1998). Efforts to improve self-efficacy by incorporating information related to the health benefits of exercise are more likely to increase long-term adherence, especially among women (Rooney, Elfessi, & Gotro, 2004).

Leisure Time Exercise (LTEQ)

The Godin leisure time exercise questionnaire (Appendix H) is a self-report instrument of exercise activity that assesses the frequency of participation in mild (easy walking), moderate (fast walking, bicycling), or vigorous exercise (running, aerobics) for at least 15 minutes per session (long enough to get sweaty) during a typical week (Godin, Jobin, & Bouillon, 1986; Godin & Shephard, 1985). This instrument was chosen as it measures all three indicators of exercise participation (frequency, intensity, and duration). Only the reported frequencies of moderate and strenuous intensity exercise were included in the analysis to meet the current recommendations for exercise and breast cancer risk reduction (Presidents Council on Physical Fitness and Sports**,** 2005). Participation in ≥ 30 minutes a day of moderate activity and/or ≥ 15 minutes of vigorous activity at least three times a week qualified for participating in regular physical activity. The second question addressed the frequency of weekly participation in regular strenuous activity (heart beats rapidly). Individuals who participated "often" qualified for participating in regular physical activity (≥ 3 times/week).

The LTEQ has been well established in previous research and considered both valid and reliable (Cardinal, 1995; Godin et al., 1986; Godin & Shephard, 1985). The instrument has been shown to be easy to understand, valid, with adequate test-retest reliability based on previous research (Jacobs, Ainsworth, Hartman, & Leon, 1993). The one month test-retest reliabilities of the strenuous intensity, moderate intensity, and mild intensity are .24, .36, and .84 respectively. Previous test-retest reliability ($r = .74$) and construct and predictive validity of the self-report measure have been adequately demonstrated (Ainsworth, Richardson, Jacobs, & Leon, 1992; Cardinal).

Data Collection

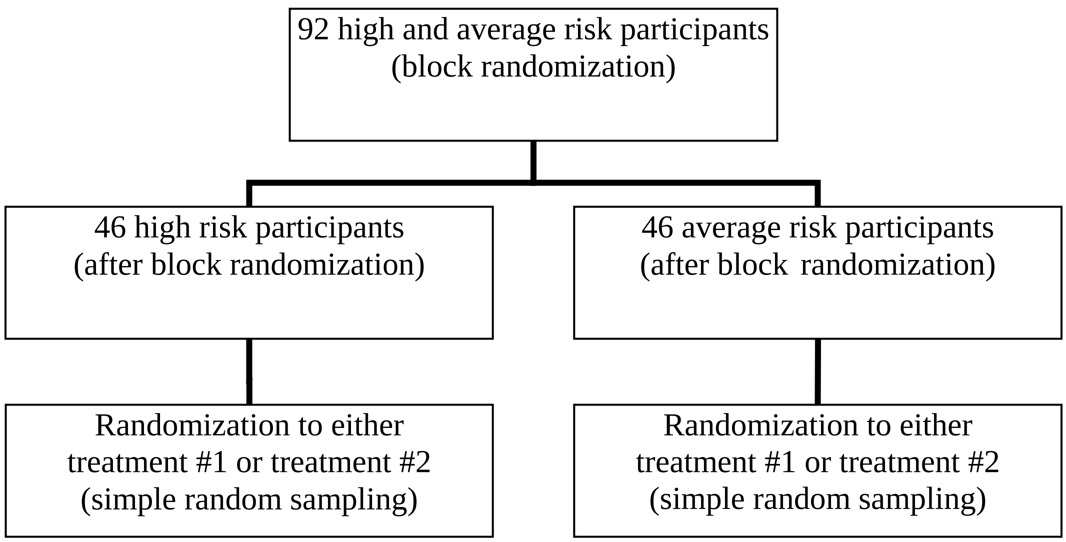
Upon completion of services in the Breast Care Center/Mammography facility, any woman interested in participating in the study was directed to the researcher's private office within the Breast Care Center by one of the receptionists. Eligibility requirements were reviewed with each participant and the Zung self-rating depression scale (Appendix B) was administered before inviting her to participate in the study. The study was explained in full detail and all questions answered before obtaining written consent. After obtaining written consent, demographic information (Appendix D) was collected from each participant.

After enrollment, a woman's absolute 5-year and lifetime breast cancer risk were determined using an interactive computer tool at http://www.cancer.gov/bcrisktool to calculate a Gail risk score based on a statistical model known as the Gail model (Gail et al., 1989). Gail risk scores were discussed with each participant, indicating whether she is considered to be at high risk or average risk of developing breast cancer over the next five years and in her lifetime as compared to the average woman. Women were blocked by Gail risk status using quota sampling to ensure an equal number in each stratum for the planned statistical analysis (Figure 4).

A list of providers of counseling services (mental health professionals) was given to each participant in case there was a need for additional counseling based upon her Gail risk assessment. Contact information for Social Services at St. Luke's Hospital and the Department of Pastoral Care was given to each participant prior to her leaving the facility. Social Service and the Department of Pastoral Care were on call and available 24 hours a day for immediate counseling and could arrange further counseling services with a mental health professional, if needed. Each participant could schedule an appointment in the Breast Care Center or meet with a genetic counselor at St. Luke's Hospital for consideration of genetic testing if she so desired.

After block randomization, each participant was assigned to one of two treatments using simple random sampling. Simple random sampling gave every participant an equal chance of being assigned to either treatment (Polit & Beck, 2004). Participants assigned to Treatment #1 (control) received the standard of care consisting of general written information. Participants assigned to treatment #2 (experimental) received specific written health and exercise knowledge information. The 46 high risk participants were pre-assigned a number ranging from 1 to 46 written on individual slips of paper to be put into a hat. The first 23 individuals drawn out of the hat were pre-assigned to group I and the second 23 individuals drawn out of the hat were pre-assigned to group II. A coin with "heads" representing treatment #1 and "tails" representing treatment #2 was tossed ahead of time to randomly assign participants to treatments. The same process was repeated for

Figure 4. Organizational chart depicting a randomized block design. The variable risk, which could not be ethically manipulated, was a blocking variable in this study.


92 high and average risk participants
(block randomization)
46 high risk participants
(after block randomization)
46 average risk participants
(after block randomization)
Randomization to either
treatment #1 or treatment #2
(simple random sampling)
Randomization to either
treatment #1 or treatment #2
(simple random sampling)

the 46 average risk participants. Any additional participants accrued in the study due to quota sampling were randomized using a similar simple random sampling method.

Participants who were randomized to treatment #1 received general written information consisting of a one-sided laminated handout (Appendix I) discussing risk factors for breast cancer and lifestyle-related factors as published by the American Cancer Society (2007) and the American Institute for Cancer Research (2004, 2005). This information is readily available to all women who are interested in learning more about breast cancer risk factors and prevention and is considered the standard of care. Participants randomized to treatment #2 received a two-sided laminated handout: general written information (Appendix I) and specific written health and exercise knowledge information (Appendix J). The second side of the handout described the benefits of exercise in relationship to breast cancer risk, lists specific physical activities that constitute moderate or vigorous energy expenditure defined by the LTEQ and set forth by the President's Council on Physical Fitness and Sports, and gives exercise tips in how to get started with an exercise program (American Cancer Society, 2002, 2006, 2007; American College of Sports Medicine, 1995; & American Institute for Cancer Research, 2004, 2005). Information in the handout was discussed and clarified with each participant to be sure she understood the material given to her.

Before leaving the facility, each participant was given a white folder containing the following items: a computer printout of her Gail risk scores, a flyer, either a one-sided or two-sided laminated handout (Appendix I or J) and a magnet to display the information on her refrigerator, a list of counseling services and contact information, a bookmark, and contact information for the researcher and chairperson along with a copy of the consent form.

Each participant was told to expect a mailed questionnaire packet in three months to complete and return to St. Luke's Hospital in the return postage-paid envelope. She was also told to expect a $5 gift card along with the mailed questionnaire packet as a token gesture of appreciation for her participation. The mailed questionnaire packet contained written instructions and the following instruments: breast cancer susceptibility subscale, confidence (self-efficacy) questionnaire, and leisure time exercise questionnaire (LTEQ). A reminder letter was mailed to any participant who failed to return the questionnaire packet within two weeks, as well as attempting a follow-up phone call to encourage her participation. A second reminder letter was sent out four weeks later as a final attempt. The procedure for data collection is summarized in the following steps:

1. Determine eligibility, complete Zung depression scale, and enroll participant
2. Participant completes demographic information sheet
3. Conduct Gail model risk assessment with participant
4. Group assignment and randomization to either treatment (experimental or control)
5. Completion and return of mailed questionnaire packet (three month follow-up)

Data Analysis

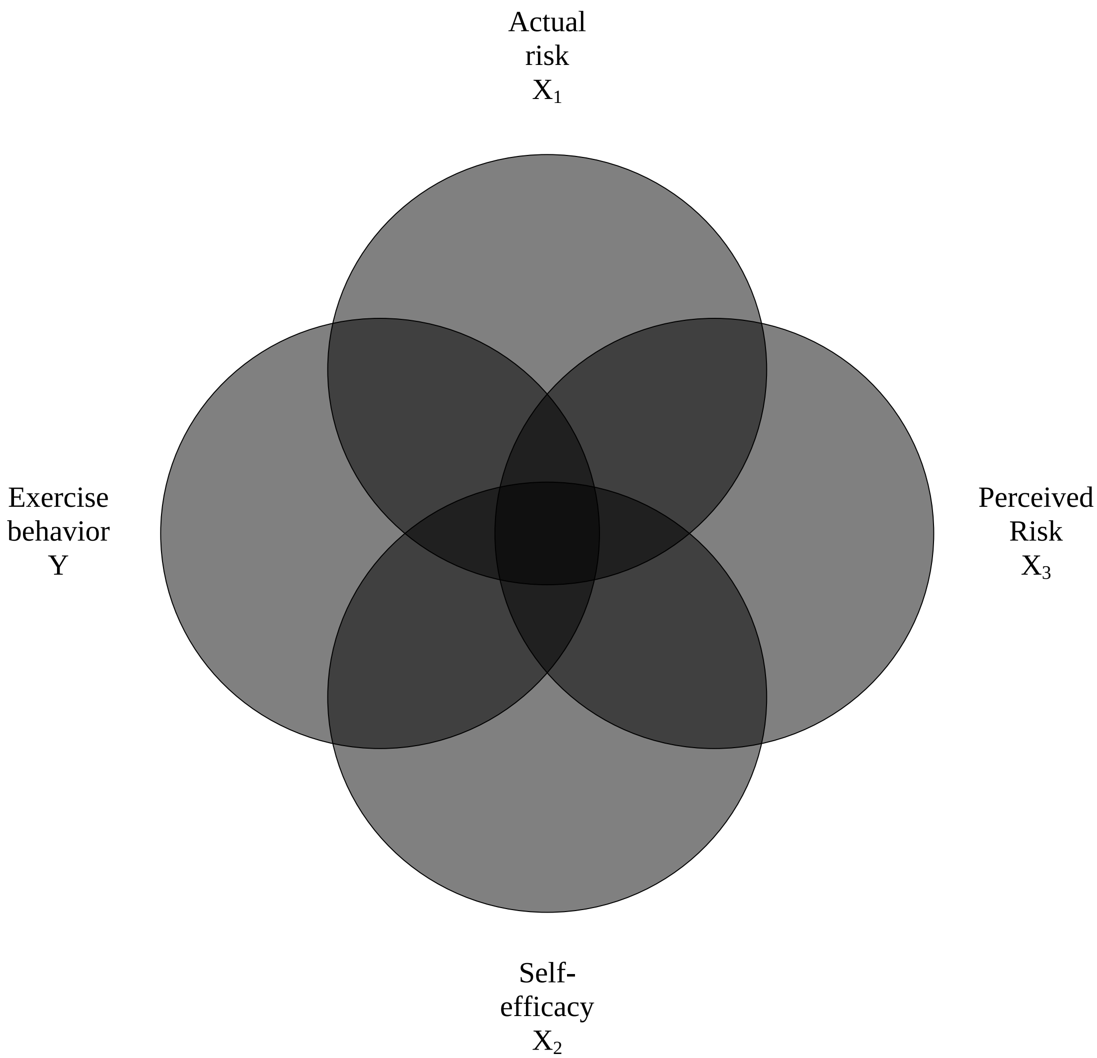
Descriptive statistics were used to describe and explore the demographic variables such as age, ethnicity, weight and height, marital status, educational level, and job classification. Additional analyses were conducted to determine if there were any significant correlations between the independent variables, dependent variables, treatment groups, and/or the demographic data. Pearson's chi-square test and analysis of variance

(ANOVA) were used to assess statistical differences between groups with significance set at $\alpha = 0.05$. Pearson's chi-square test was used to assess whether the number of individuals at high risk predicted by the Gail risk model would equal that of the susceptibility model. Treatment groups and other variables were assessed with statistical analyses performed using Statistica version 6 (Statsoft Inc., Tulsa, OK).

Multiple regression (Cohen, Cohen, West, & Aiken, 2003; Nunnally & Berstein, 1994; Tabachnick & Fidell, 2001) analysis, one of the most widely used multivariate procedures, was used to understand the effects of two of more independent variables (actual risk, perceived risk, and self-efficacy) on a dependent variable (exercise behavior). Multiple regression analysis is often used to make predictions or explain as much of the variance in the value of a dependent variable as possible (see Figure 5). Regression analysis is specifically designed to test the validity of a theoretically proposed statement expressed as a regression equation (Burns & Grove, 2005; Polit & Beck, 2004; Tabachnick & Fidell, 2001).

Simultaneous multiple regression analysis was performed using Statistica version 6 software to test the first two hypotheses. Simultaneous multiple regression is useful when there are a small number of independent variables and if theory dictates that all independent variables should be entered into the model at the same time. Since both predictors in this study (risk and self-efficacy) were considered to be of equal importance to the research question, a single regression equation was developed. The value of R^2 was interpreted as the proportion of the variability in the dependent variable accounted for or

Figure 5. Visual representation of multiple regression variables in study.


Actual
risk
X_1
Exercise
behavior
Y
Perceived
Risk
X_3
Self-
efficacy
X_2

.

explained by the independent variables. The F ratio was used to test the null hypothesis and if significant, suggests that the independent variables (risk and self-efficacy) are making a significant shared contribution to the prediction of the dependent variable, thus allowing rejection of the null hypothesis, as posited by research hypotheses 1 and 2 in this study.

Hierarchical multiple regression analysis using Statistica version 6 software was conducted to test the third hypothesis. Hierarchical multiple regression is useful to examine the effects of an important independent variable after removing the effect of other variables, entering predictors into the equation based on logical or theoretical considerations (Polit& Beck, 2004). Hypothesis 3 suggests that subjective breast cancer risk needs to match objective breast cancer risk to be an effective tool in predicting exercise behavior in women. Objective risk and self-efficacy were entered first (step 1) followed by perceived risk (step 2) to see if perceived risk predicts above and beyond the other two independent variables. An R^2 value was computed for each stage of the analysis to observe for any statistically significant change and incremental increase in the R^2 value, thus adding to the prediction model (Huck, 2004).

For the purpose of clarification, the following table (Table 1) has been included to help the reader understand how data was analyzed for the variables in this study.

Table 1

Organizational Table Depicting Study Variables, Data Collection, and Analysis

Variable	Data Collection	Data Analysis
Actual risk (IV)	Gail model	Simultaneous and hierarchical multiple regression
Self-efficacy (IV)	Confidence/self-efficacy	Simultaneous and hierarchical multiple regression
Perceived risk (IV)	Susceptibility	Hierarchical multiple regression
Exercise behavior (DV)	Leisure time exercise	Simultaneous and hierarchical multiple regression

Chapter 3 identified the design, setting, sample, methods, and analyses used to conduct the research in this study. Chapter 4 will discuss the data analysis procedures and present the results of the study, including any pertinent supplemental analyses.

CHAPTER 4

RESULTS

Chapter 4 presents the results along with the statistical analyses procedures used in this study. The hypotheses provide direction for the analyses of study data. Tables, graphs, and charts are included and appropriately discussed in the results. The overall purpose of this study was to determine whether risk and/or health information and accurate exercise knowledge could motivate a woman to exercise and to gain a deeper understanding of how risk perception impacts exercise behavior based upon the theory of protection motivation (Rogers, 1983).

Participants

A convenience sample of women, aged 40 to 65 years old, was chosen to reflect an adequate representation of middle-aged women in the population who receive annual mammography screening and clinical breast examination. A total of 96 (46 high and 50 average risk) participants were accrued in this study, which took about four months to complete. The Zung self-rating depression scale was administered prior to enrollment to determine eligibility. There were no women eliminated from this study based on their depression scores. Mean time to follow-up was three months from the time of enrollment. A total of 96 questionnaire packets were mailed. After two weeks a reminder letter was mailed to 25 participants along with an attempted phone call reminder. An additional reminder letter was mailed 2 weeks later to 12 of those participants who had not yet responded. Of the 96 participants enrolled in the study (46 high risk and 50 average risk), 13 participants (8 high risk and 5 average risk) were considered lost to follow-up with an overall 86.4% return rate. Typical response rates have been shown to be less than 65% in most studies (Polit and Beck, 2004). Of the returned questionnaire packets, there were no missing data. A total of 83 participants completed the study, 38 of which were considered high risk (46%) and 45 average risk (54%), and all were included in the data analysis.

Descriptive Data

The demographic variables in this study were marital status, educational background, age, race, body mass index, and employment status and were used to describe the sample characteristics. The majority of participants were Caucasian (98%) and the remainder were African American (2%), adding validity to the use of the Gail model in this study, which has been shown to accurately predict breast cancer risk in white women and those with a family history of breast cancer (Gail et al., 1989). Most were currently married (76%) and employed full or part-time (87%). Participants were well educated with well more than half having a college degree (78%). The average body mass index (BMI) was 27.85 and 63% were considered overweight. These figures coincide with the national average, which indicates that 56% of women in the United States are either overweight or obese, reflecting a 62.9% increase since 1991 (USDHHS, 2000).

The experimental and control groups were compared on demographic variables to ensure that they were similar before implementation of the treatment using ANOVA. There were no statistically significant ($p > .05$) demographic differences in marital status, educational background, age, race, body mass index, and educational status between participants in either group (see Table 2).

Table 2

Demographic Averages of Participants

	All Individuals	Control	Experimental	F Score	P Value * (p > .05)
Marital Status	2.0241	2.0233	2.0250	0.000183	0.989249*
Education	3.0843	3.0698	3.1000	0.036192	0.849595*
Age	51.6627	50.6512	52.7500	1.943156	0.167139*
Race	1.0241	1.0233	1.0250	0.002616	0.959332*
BMI	27.8542	28.2186	27.4625	0.353160	0.553986*
Employment	0.8675	0.8837	0.8500	0.200522	0.655496*

Note. Marital Status: (1) = single (2) = married (3) = divorced (4) = separate (5) = widowed. Education: (1) = grade school (2) = high school (3) = undergraduate (4) = graduate. Age = years old. Race: (1) = Caucasian (2) = African American (3) = Hispanic (4) = Asian (5) = other. BMI (Body Mass Index) = weight (kg) ÷ height (meters^2). Employment: (0) = unemployed (1) = employed.

Statistical Analysis Procedures

An experimental, randomized block, prospective design was implemented to answer the following research questions: Can Gail risk and/or self-efficacy predict exercise behavior among women who are at higher risk for developing breast cancer and does Gail risk need to match perceived susceptibility to effectively influence such health promoting behavior? Selection of the independent variables (Gail risk, perceived susceptibility, and self-efficacy), and the dependent variable (exercise behavior) in the present study was based on the theoretical suppositions proposed by the theory of protection motivation (Rogers, 1983). For protection motivation to occur, the individual must believe in the severity of the threat, personal susceptibility, and the benefits and efficacy of adopting a valued health behavior such as exercise. Based on these suppositions, the following hypotheses were tested in this study:

1. A woman who is at higher risk of developing breast cancer is more likely to participate in regular physical activity (≥ 3 times/week) than a woman at average risk of developing breast cancer.
2. A woman who receives specific written health and exercise knowledge information is more likely to participate in regular physical activity (≥ 3 times/week) than a woman who receives general written health information only.
3. Breast cancer risk perceptions need to match objective breast cancer risk estimates to be an effective tool in predicting exercise behavior in women.

Participants Gail risk scores were determined, and after blinded block randomization; each participant was assigned to either treatment #1 (general written information) or treatment #2 (specific written information). Each participant completed a questionnaire packet after three months containing the following instruments: breast cancer perception (Susceptibility), exercise participation confidence (Self efficacy), and current exercise participation (LTEQ). It was hypothesized that women who received specific health and exercise information were more likely to participate in regular physical activity (≥ 3 times/week) than women who received general health information only. Since health information has been shown to enhance self-efficacy and promote exercise participation it was important to note if there were any differences in instrument scores between treatment groups. Analysis of variance (ANOVA) was conducted to test the mean instrument scores for the control and experimental groups to determine if they came from the same population. After collection of the data (see Table 3), no differences were found in any of the instrument scores between treatment (general vs. specific written information) groups ($p > .05$). Since average scores were similar between the control and experimental groups, data from the control and experimental groups were allowed to be pooled for use in multiple regression analysis that follows.

Table 3

Average Scores of Participants for All Instruments

	All Individuals	**Control**	**Experimental**	**F Score**	**P Value** * (p > .05)
Gail Risk Score	1.7301	1.7767	1.6800	0.216931	0.642638*
Susceptibility Score	12.7349	12.7674	12.7000	0.004413	0.947199*
Self Efficacy Score	2.3711	2.4605	2.2750	1.411757	0.238237*
LTEQ Score	2.5542	2.5349	2.5750	0.006050	0.938192*

Multiple Regression Analysis

The purpose of multiple regression is to predict or explain as much of the variance in the value of a dependent variable as possible. Multiple regression analysis is used to understand the effects of two of more independent variables on a dependent variable and is used most often to make predictions. Regression analysis is specifically designed to test the validity of a theoretically proposed statement expressed as a regression equation (Burns & Grove, 2005; Polit & Beck, 2004; Tabachnick & Fidell, 2001).

Testing the Assumptions

Multiple regression analysis assumes that the independent and dependent variables will be measured without error and that the variables will be treated as interval level measures. Certain assumptions must be met to be able to generalize findings and make inferences beyond the sample to the general population.

Sample size. Determining the appropriate sample size by performing a power analysis increases the ability to generalize findings. Using G-Power computer software (Faul & Erdfelder, 1992) to conduct a power analysis and the standard respective parameters for alpha (.05), population medium effect size (0.15), power (0.80), and predictors (3), a total of 77 participants were needed to conduct multiple regression analysis. Factoring in an approximate 20% anticipated attrition rate, 96 participants were recruited (46 high risk and 50 average risk using a quota sampling method).

Multicollinearity. Multicollinearity was checked before conducting the regression analyses to determine how strongly the independent variables were correlated with the dependent variable and to each other (see Table 4). The resulting correlation matrix was carefully examined for evidence of multicollinearity, evidenced as greater than .7 (Tabachnick & Fidell, 2001). It was determined that the bivariate correlation between each of the independent variables was within the acceptable range of less than .7, therefore all variables were retained in the prediction model.

Table 4

Correlations between Dependent and Independent Variables

Pearson Correlation	**Gail**	**Susceptibility**	**Self-efficacy**	**LTEQ**
Gail	1	0.35	-0.02	0.01
Susceptibility	0.35	1	-0.12	-0.00
Self-efficacy	-0.02	-0.12	1	0.38
LTEQ	0.01	-0.00	0.38	1

Normality, homoscedasticity, linearity and outliers. Assumptions for normality were checked by reviewing the residual scatterplots and the Normal Probability Plot (Tabachnick & Fidell, 2001). The scatterplot diagram (Figure K1) shows the standardized residuals indicating that most of the scores are concentrated in the center, being roughly distributed in a rectangle. Dependent variable scores are normally distributed, suggesting a normal distribution of Y scores at each value of X with equal variance at each value of X, thus error scores show no departure from linearity. When normality is met, so is homoscedasticity. The presence of a few outliers did not necessitate taking any action, especially since there were no missing data. Since no differences between treatment groups were determined, linear regression models using the data for all participants were constructed to determine what variables affected LTEQ. All instrument scores for participants followed normal distributions (Figures L1-4). Therefore, Gail risk, susceptibility, and self-efficacy were considered independent variables to the dependent variable exercise behavior (LTEQ).

Hypotheses One and Two

Simultaneous multiple regression analysis was performed to analyze data for the first two hypotheses to test the effect of two independent variables (Gail risk and self-efficacy) on one dependent variable (exercise behavior). Simultaneous multiple regression is useful when there are a small number of independent variables and if theory dictates that all independent variables should be entered into the model at the same time. Since both predictors in this study (Gail risk and self-efficacy) were considered to be of equal importance to the research question, a single regression equation was developed.

Gail risk and self-efficacy were entered into the model at the same time, where the value of R^2 was interpreted as the proportion of the variability in the dependent variable accounted for or explained by the independent variables. The model accounts for 15% of the variance in the dependent variable (exercise behavior) as explained by the independent variables (risk and self-efficacy). The F ratio used to test the null hypothesis was statistically significant from zero, $F(2, 80) = 7.15$, $p = .001$, suggesting that the independent variables (risk and self-efficacy) made a significant contribution to the prediction of the dependent variable (exercise behavior) in this study (see Table 5).

Table 5

Model Summary[b]

Model	R	R^2	F	p-level	Standard error of estimate
1	0.389437[a]	.151661	7.150974	.001389	2.1760

Note. [a.] Predictors: Gail risk, self-efficacy. [b.] Dependent variable: exercise behavior.

Table 6 displays the standardized regression coefficients (Beta) of each independent variable indicating which variables statistically contributed (p-level) to the prediction equation. Self-efficacy, but not Gail risk made a significant unique contribution to the prediction of exercise behavior.

Table 6

Standardized Regression Coefficients[a]

Model	Beta (Standardized Coefficients)	Significance (p-level)
Gail Risk	0.029	.775
Self-Efficacy	0.389	.000

Note. [a.] Dependent variable: exercise behavior.

Hypothesis Three

Hierarchical multiple regression was conducted to analyze data for the third hypothesis which proposed that breast cancer risk perceptions need to match objective breast cancer risk estimates to be an effective tool in predicting exercise behavior in women. Hierarchical multiple regression is useful to examine the effects of an important independent variable after removing the effect of other variables, entering predictors into the equation based on logical or theoretical considerations (Polit & Beck, 2004). Gail risk and self-efficacy were entered first (step 1) followed by perceived susceptibility (step 2) to see if perceived susceptibility predicted above and beyond the other two independent variables. An R^2 value was computed for each stage of the analysis to observe for any statistically significant change and incremental increase in the R^2 value, thus adding to the prediction model (see Table 7).

Table 7

Model Summary[c]

Step	R	R^2	R Square Change	F Change	Significance (p-level)	Variables Included
0	0.389437[a]	0.151661				2
1	0.391161[b]	0.153007	0.001345	0.12549	.724099	3

Note. [a.] Predictors: Gail risk, self-efficacy. [b.] Predictors: Gail risk, self-efficacy, and susceptibility. [c.] Dependent variable: exercise behavior.

The addition of susceptibility to the model did not increase the value of R^2. Perceived susceptibility did not predict exercise behavior or predict above and beyond Gail breast cancer risk estimates as hypothesized in this study. Table 8 displays the standardized regression coefficients (Beta) of each independent variable indicating which variables statistically contributed (p-level) to the prediction equation. Self-efficacy was the only variable to significantly contribute to the prediction equation.

Table 8

Standardized Regression Coefficients[a]

Model	Beta (Standardized Coefficients)	Significance (p-level)
Gail Risk	0.015	.887
Self-Efficacy	0.393	.000
Susceptibility	0.039	.724

Note. [a.] Dependent variable: exercise behavior.

Analysis of the hypotheses 1 & 2 determined that Gail risk scores and self-efficacy scores positively correlated with LTEQ scores as hypothesized where 15.0 % of the error is accounted by the variance. Analysis of hypothesis 3 determined that the stepwise addition of susceptibility did not increase the value of R^2. Further analysis of the models revealed that self-efficacy scores alone correlate with LTEQ scores (Figure 6), where 15.0 % of the variance was accounted, while Gail risk and susceptibility scores alone do not correlate with LTEQ scores (Figure 7 & 8, respectively). Furthermore, hierarchical regression analysis determined that Gail risk scores do not increase the value of R^2 when added to a self-efficacy and LTEQ model. Therefore, self-efficacy scores can predict exercise behavior (LTEQ), while Gail risk and susceptibility add no insight to current exercise behavior.

Figure 6. LTEQ scores versus self-efficacy. Analysis of hypotheses 1 and 2 determined that Gail risk scores and self-efficacy scores positively correlated with LTEQ scores as hypothesized where 15.0 % of the error is accounted by the variance. However, hierarchical regression analysis revealed that the self-efficacy model accounted for the correlation with LTEQ scores found in hypothesis 1 and 2. There is a corrleation slope of 1.27 with an R^2 value of 0.151.

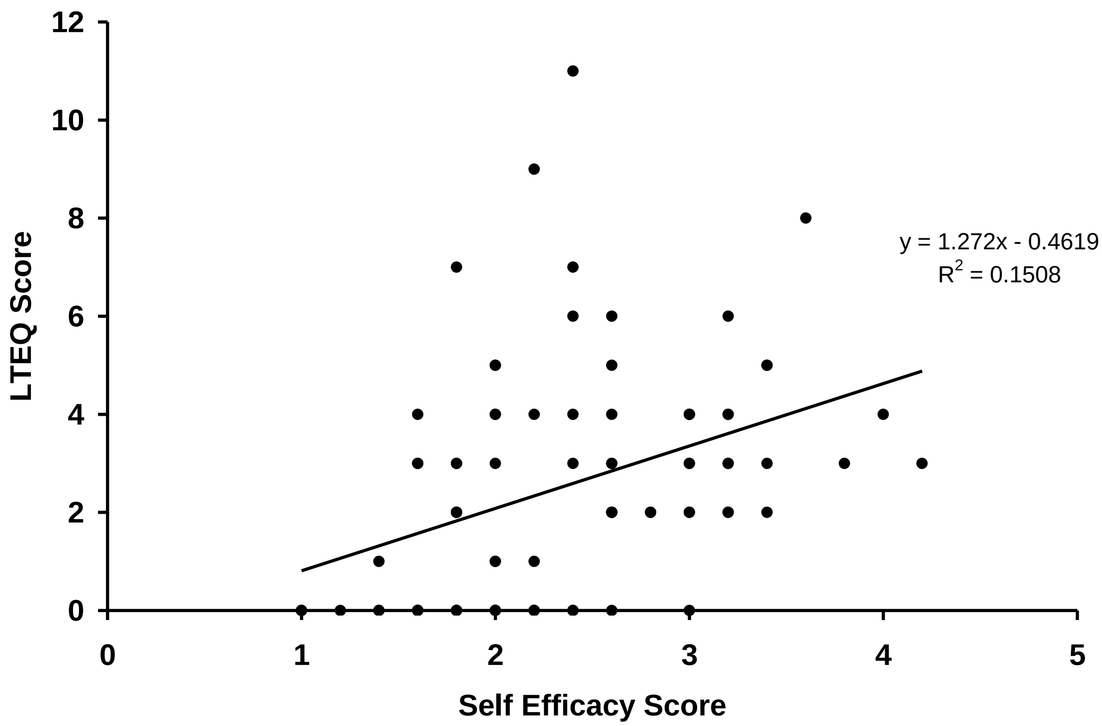

12
10
8
6
4
2
0
LTEQ Score
0
1
2
3
4
5
Self Efficacy Score
y = 1.272x - 0.4619
R2 = 0.1508

Figure 7. LTEQ scores versus Gail risk model scores. The Gail risk model did not correlate with LTEQ scores and was not found to predict exercise behavior.

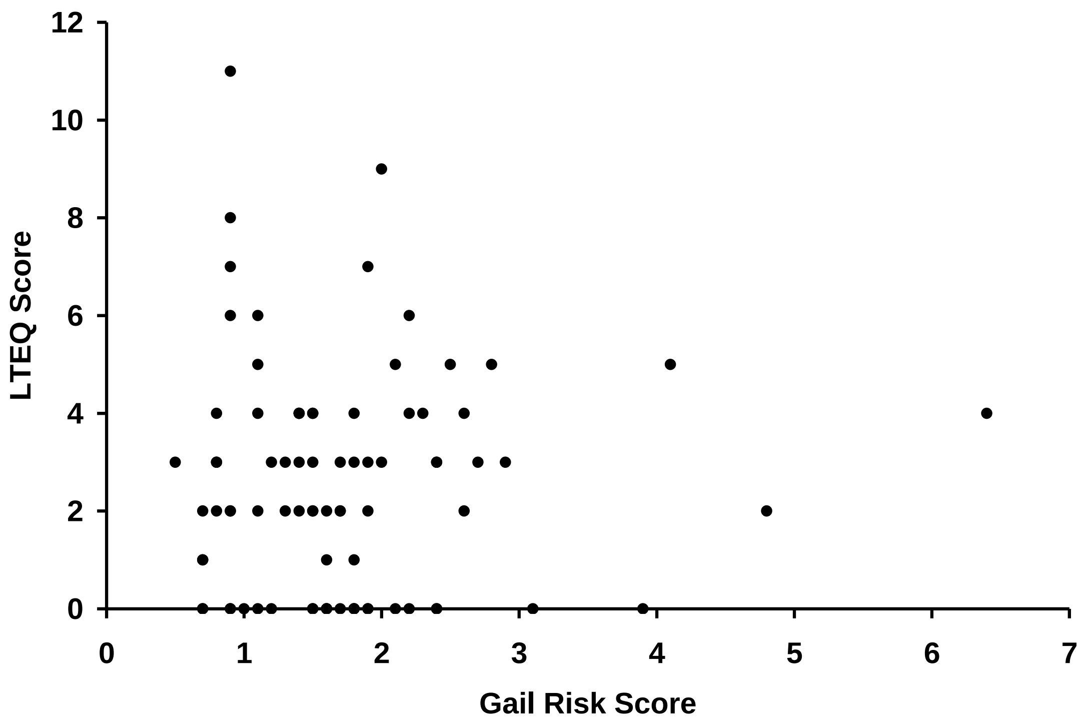
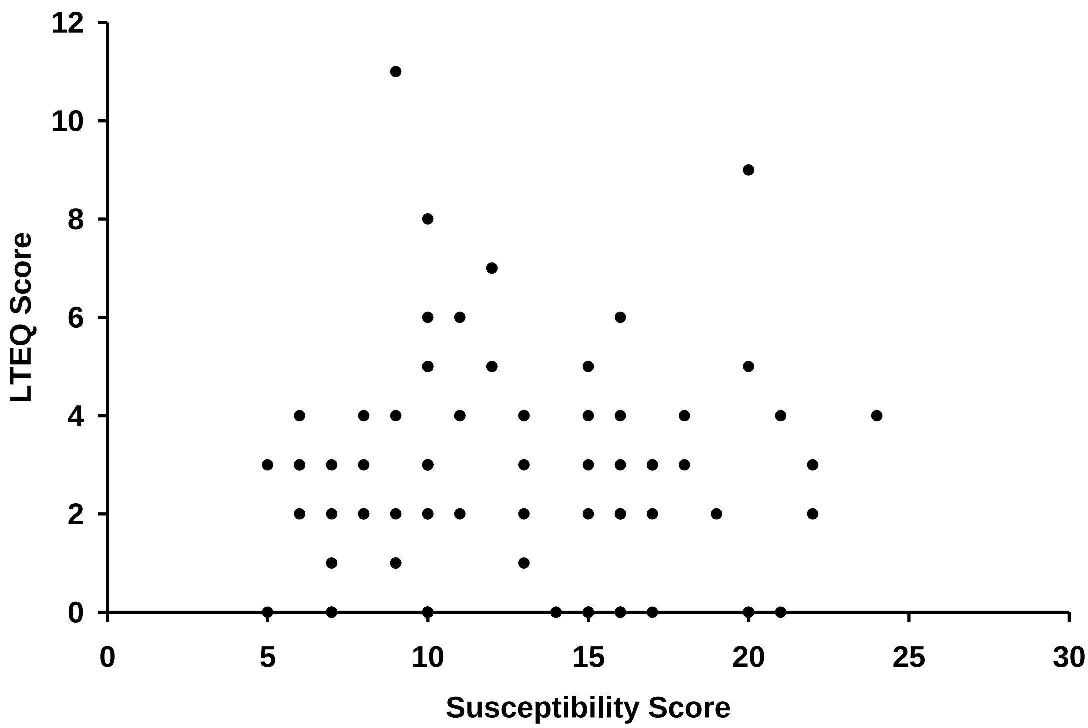

12
10
8
6
4
2
0
LTEQ Score
0
1
2
3
4
5
6
7
Gail Risk Score

Figure 8. LTEQ scores versus susceptibility model scores. The susceptibility model did not correlate with LTEQ scores and was not found to predict exercise behavior.


12
10
8
6
4
2
0
LTEQ Score
0
5
10
15
20
25
30
Susceptibility Score

Additional Analysis

The data were further analyzed by chi-square, goodness of fit/Pearson's test to determine if women who were at higher risk of developing breast cancer were more likely to perceive themselves as being at higher risk. Women from either treatment group were classified as at high risk if their Gail risk score was 1.67 or greater, while average risk was considered as a score of less than 1.67. Women from either treatment group perceived themselves to be at high risk if their susceptibility score was 20 or greater. Both treatment groups contained approximately equal distributions of high and average Gail risk women and high perceived risk women (Table 9), however, both treatment groups contained fewer high perceived risk women than predicted based on the number of women categorized as being at high risk as determined by their Gail risk score.

Table 9

Number of Participants in Each Category for Gail Risk and Susceptibility Models

	All Individuals	**Control**	**Experimental**
Average Gail Risk	45	22	23
High Gail Risk	38	21	17
High Susceptibility	9*	4*	5*

Note. * indicates statistical significance ($p < .05$) versus predicted number based on number of high Gail risk participants for each group determined by chi-square, goodness of fit/Pearson's test.

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ANOVA testing was conducted and no differences were found between susceptibility, self efficacy, or LTEQ scores for high and average risk women regardless of treatment (p > .05). In particular, self-efficacy scores were not significantly different for high risk women as compared to average risk women regardless of treatment (p > .05) as shown in (Table 10).

Table 10

Averages for High and Average Risk Women

Average Gail Risk	**Control**	**Experimental**	**F Score**	**P Value** * (p > .05)
Gail	1.040909	1.26250005	0.74755	0.392978*
Susceptibility	11.04545	10.916667	0.034691	0.853291*
Self-Efficacy	2.609091	2.24166656	0.104263	0.74864*
LTEQ	2.863636	2.33333325	1.196509	0.281286*
High Gail Risk	**Control**	**Experimental**	**F Score**	**P Value** * (p > .05)
Gail	2.547619	2.27647066	0.74755	0.392978*
Susceptibility	14.57143	14.8235292	0.034691	0.853291*
Self-Efficacy	2.304762	2.37647057	0.104263	0.74864*
LTEQ	2.190476	3.0	1.196509	0.281286*

Since treatment did not affect any of the variables, women from both treatment groups were pooled into their respective high and average risk groups for further analysis (Table 11). It was hypothesized that women who were at higher risk of developing breast cancer were more likely to participate in regular physical activity (≥ 3 times per week) than women at average risk of developing breast cancer. ANOVA testing determined that high

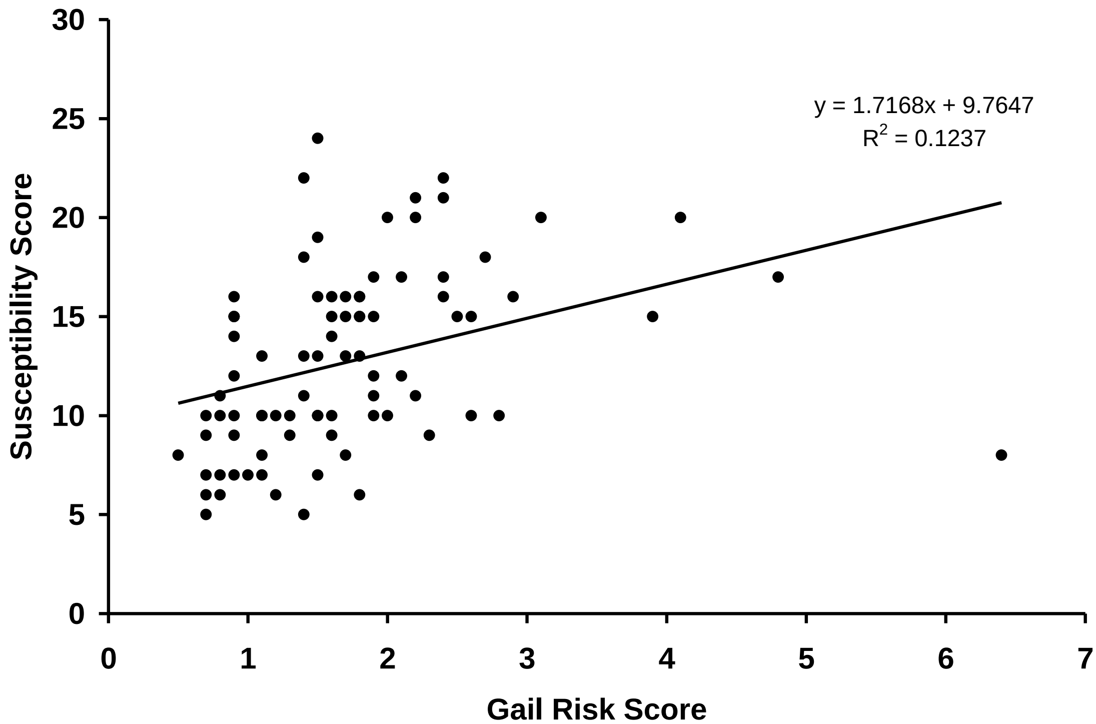
Table 11

Averages for All Individuals between Instrument Scores

All Individuals	High Gail Risk	Average Gail Risk	F Score	P Value * (p > .05)
Gail	2.426316	1.156522	70.43	< 0.0000001
Susceptibility	14.68421	10.97826	15.73712	0.000155
Self-Efficacy	2.336842	2.417391	0.262636	0.609693*
LTEQ	2.552632	2.586957	0.004482	0.946785*

risk women were not more likely to participate in exercise based on similar LTEQ scores between groups (F = 0.004482, p = .946785); however, high risk women did tend to perceive themselves as being at more risk as their average susceptibility score was 14.7 while the average risk women scored 11.0 (F = 15.73712, p = .000155). While women at high risk did score higher in susceptibility, they did not score high enough on average to be considered for the high perceived risk category (20 or greater). Additionally, it was found that by considering all Gail risk and susceptibility scores (both high and average risk individuals), the Gail Risk model positively correlated with the susceptibility model (F = 11.434, p = .001112, R^2 = 0.124) as illustrated in (Figure 9).

Figure 9. Susceptibility model scores versus Gail risk model scores. By considering all Gail risk and susceptibility scores (both high and average risk women), the Gail risk model positively correlated with the susceptibility model, with a correlation slope of 1.72 and R^2 of 0.124.



30
25
20
15
10
5
0
Susceptibility Score
0
1
2
3
4
5
6
7
Gail Risk Score
y = 1.7168x + 9.7647
R2 = 0.1237

Chapter 4 presented the results from the statistical analyses procedures used for each of the hypotheses in this study. Multiple correlation analysis, Pearson's chi-square test, and analysis of variance (ANOVA) were conducted to analyze the data. Chapter 5 will summarize and discuss the findings along with the limitations and implications of the findings, and present recommendations for future research.

CHAPTER 5

DISCUSSION

This chapter presents a summary and discussion of the findings, placing the findings within the context of previous research. Chapter 5 also includes the limitations of this study, implications of the findings, and recommendations for future research.

Summary and Discussion of the Findings

Results of the first analysis focused on whether risk and/or health information and accurate exercise knowledge could motivate a woman to exercise. The second analysis attempted to explore the accuracy of a woman's perception of breast cancer risk in relationship to her Gail model score. Additional analyses were conducted to determine if there were any significant correlations between the independent variables, dependent and/or the demographic data.

First Analysis

The first hypothesis proposed that a woman who was considered at higher risk of developing breast cancer based on her Gail model score would be more likely to participate in regular physical activity than a woman who was considered at average risk of developing breast cancer. The second hypothesis proposed that a woman who received specific health information as opposed to general health information was more likely to participate in regular physical activity. Findings from this study supported the second hypothesis, but not the first hypothesis. A woman whose Gail risk score indicated that she was at higher risk than the average woman of developing breast cancer was no more likely to participate in regular physical activity than a woman whose Gail risk score indicated that she was at average risk of developing breast cancer. However, a woman who received specific written health information was more likely to participate in regular physical activity than a woman who received general health information.

There are a number of plausible reasons why the threat appraisal components were not successfully manipulated in this study. One possible explanation could be that the Gail model used to determine risk was based on factual information and women may not have completely understood the model or the results. Perhaps the women in this study did not fully comprehend their risk and therefore did not gain any appreciation of the need to exercise. According to Rogers (1975), an individual must feel a personal sense of being at high risk to be motivated enough to adopt preventative and protective health behavior.

Another plausible explanation as to why the threat appraisal components were not successfully manipulated in this study is that threat alone may be insufficient in motivating individuals to protect themselves. Wurtele and Maddux (1987) found that while persuasive messages may be effective in enhancing intention to change behavior, such messages may be insufficient to produce actual behavioral change. Previous findings in health threat literature suggest that threat appraisal process alone may not be enough to elicit protection motivation; the coping appraisal process may also be needed to motivate individuals to protect themselves in an adaptive way. While threatening communication is necessary to motivate an individual to act, coping information received is the most critical factor in predicting responses (Rippetoe & Rogers, 1987). Perceived self-efficacy, a pivotal component of the social cognitive theory, plays a central role in the self-regulation of motivation through goal challenges and outcome expectations (Bandura, 2001; Bandura, 1997; Schwarzer, 1992). Even though almost half the women in this study were told that they were at higher risk for breast cancer based on their Gail risk assessment, it may not have been enough of a stimulus to elicit protection motivation. Although, when combined with increased self-efficacy, was enough to produce behavioral change, as suggested in this study.

The present study adds support to the existing body of knowledge suggesting that self-efficacy plays a major role in determining both protection motivation and health behavior (Courneya & Hellsten, 2001; Milne et al., 2002; Rippetoe & Rogers, 1987; Schwarzer & Fuchs, 1996; Wurtele & Maddux, 1987). A meta-analytic review of protection motivation theory, suggests that the threat and coping appraisal components can be useful in the prediction of health-related intentions (Milne et al., 2000). Although, coping appraisal variables have been shown to predict intention and behavior more often than threat appraisal variables. This held true in this study, as self-efficacy, but not risk, was shown to predict exercise behavior.

Self-efficacy was successfully manipulated in this study and was shown to promote exercise behavior. Women were more likely to participate in regular physical activity if given specific instructions about the type of exercise needed to achieve the desired results than women who received general health information. Apparently, general health information that provides factual risk education was insufficient in affecting behavioral change. By providing individuals with more tailored instructions, levels of self-efficacy increased, as did exercise participation.

Findings from this study provide support for the potential influence that health care providers can have in promoting physical activity by providing individuals with more tailored instructions to achieve greater levels of self-efficacy (Speck, 2002; Stutts, 2002). Although given the design of this study, it is difficult to know with certainty if it was the information or the presenter that made the difference in affecting a change in health behavior. The impact of the health care provider and/or the quality or quantity of material needed to affect a change is yet to be determined. Women have expressed the need for more information that could be discussed and distributed by a health care provider (Spector, 2007). The preferred sources of information were either reading materials or the Internet. This is consistent with prior evidence in which women were more likely to exercise if given specific instructions about the type of exercise needed to achieve the desired results (Speck, 2002; Wilbur, Miller, Montgomery, & Chandler, 1998). Health information and accurate exercise knowledge has been shown to enhance self-efficacy and promote exercise participation (Corwyn et al., 1999; Fitzgerald et al., 1994; Netz et al., 2004).

Second Analysis

The third hypothesis proposed that subjective breast cancer risk perceptions needed to match objective breast cancer risk estimates for the Gail model to be an effective tool to use in predicting exercise behavior in women. Results did not support the third hypothesis in this study. Subjective breast cancer risk perceptions did not predict exercise behavior or predict above and beyond objective Gail breast cancer risk estimates as hypothesized in this study.

High risk women were no more likely to exercise even though they tended to perceive themselves as being at higher risk. However, since neither Gail risk nor perceived susceptibility predicted exercise behavior, one would not expect there to be a correlation. While neither objective Gail risk perception nor subjective susceptibility risk perception predicted exercise behavior, a positive correlation was found between Gail risk and susceptibility, suggesting that there is a moderate relationship between the two variables. Although this does not indicate causation, it may have some practical significance. As Gail risk increased, so did perceived susceptibility. However, this moderate relationship between the two independent variables may not have been strong enough to generate a response. The women in the present study may have underestimated their perceived susceptibility in order to protect themselves. Prior research has shown that women tend to be optimistically biased to feel a measure of control over an uncontrollable health threat, such as breast cancer (Facione, 2002). If a woman chooses to exercise, then psychologically, she must admit to herself that she is at increased risk. On the other hand, if she doesn't exercise than she doesn't have to worry about her breast cancer vulnerability.

Gail risk counseling may have lead to false reassurance about risk, thereby decreasing risk perception, resulting in decreased exercise intentions and behavior. Since counseling was provided by a health care provider, it is possible that women felt more secure in knowing that somebody was watching over them and generally felt less threatened. Such counseling may have instilled a sense of well-being, both physically and mentally, causing optimistic bias and less cancer worry. While women in the present study were aware of their risk, there was a failure to recognize their own personal risk in relationship to other women. Prior evidence suggest that women try to cope with health problems by acquiring knowledge about diseases such as breast cancer to determine their own personal risk as compared to other women (Facione, 2002). Perceived health status, rather than knowledge, has been shown to predict perceived vulnerability, as suggested by Eibner, Barth, and Bengel (2006).

On the other hand, women may have felt overwhelmed by the Gail risk counseling and consequently felt a sense of helplessness. Unless an individual believes she can produce desired results and delay or prevent detrimental ones by her actions, she has little incentive to act or to persevere in the face of adversity. Not only does self-efficacy have the capability of affecting adaptation and change, but can also impact other determinants and as such, influence individuals to become positively or negatively biased in ways that are self-enhancing or self-hindering (Bandura, 2001; Schwarzer, 1992). An individual must believe in her capability to reasonably control her own personal functioning and external environment. The self-efficacy intervention may not have been enough to empower these women to act to overcome adversity in the present study.

It is also possible that there are mediating variables between vulnerability, intention, and behavior that have yet to be established (Milne et al., 2000). Bandura (1986) suggested that both self-efficacy and incentives are necessary to motivate behavior, and alone, neither indicator is enough to affect the outcome. Rogers and Gauvin (1998) found that while outcomes are viewed by an individual as probable, the incentive for the outcome must be sufficient to continually motivate behavior. Mental health, stress reduction, fitness, and appearance were some of the incentives to exercise, but results did not distinguish which incentives were psychologically necessary. Barriers to exercise include diet, cost, time, inconvenience, social support, and knowledge deficit. In particular, time constraints seem to be the primary barrier to participation in physical activity (King et al., 1992; Stutts, 2002), suggesting that time constraints may actually represent a lack of interest and/or commitment to exercise since many women choose to exercise in spite of this barrier. Given that the sample in this study was primarily working women (87%), it is more likely that time constraints acted as a barrier to exercise in spite of their increased risk of breast cancer in high risk women.

Supplemental Findings

Previous research has shown that individuals will follow through with self-care activities more readily if their concerns are understood, are taught about their health threat along with specific health promoting behaviors, and encouraged to participate in their own care (Cameron, 1996; DiMatteo, et al., 1993; Phister-Minogue, 1993). Highly educated women are much more likely to participate in physical activity than those with a high school education or less. The majority of individuals in this study were highly educated with more than half of the participants having a college degree; this may have accounted for the predictive findings of self-efficacy in promoting exercise participation. Women who are more highly educated and more likely to adhere to mammography guidelines tend to participate in risk counseling programs; although, this has been shown to limit the potential effect of risk counseling interventions (Lerman et al., 1995). Since the women in the present study were more highly educated and were there to obtain a mammogram, they may have had preconceived ideas about their risk of breast cancer and therefore did not benefit from the counseling, had they been less educated. This may help explain why self-efficacy, but not risk, predicted exercise behavior in this study.

Low self-efficacy levels have been found to be associated with higher perceived barriers and vice versa (Stutts, 2002). In particular, higher levels of body mass index were found to be associated with lower levels of self-efficacy for physical activity, accounting for 8.2% of the variance. The average body mass index for women in the present study was 27.85 and 60% were considered overweight or obese, which may account for the lower levels of self-efficacy in this study. The low self-efficacy levels may have been associated with a higher perceived barrier to exercise. This is unfortunate considering the sobering evidence that women who infrequently exercise and have a body mass index above the 50^{th} percentile have a 27% and 53%, respectively, higher lifetime risk of breast cancer (Fraser & Shavlik, 1997).

Study Limitations

Although the present findings provide further evidence in support of the theory of protection motivation, there are several limitations in this study that need to be addressed. Threats to validity were controlled to aid in determining whether the independent variables (Gail risk, perceived susceptibility, and/or self-efficacy), rather than the uncontrolled extraneous variables were responsible for the dependent variable (exercise behavior).

Internal Validity

Problems in attributing causality may have occurred since risk could not be ethically manipulated in this study. Participants may not have fully appreciated their risk, enough so to convince them of the need to exercise. It may have been helpful if risk perception had been measured before and after Gail risk assessment to determine its potential impact on exercise behavior. Although, since neither Gail risk nor risk susceptibility significantly predicted exercise behavior, it is rather a moot point. It is also possible that selection bias may have occurred since individuals were not assigned randomly to high and low risk conditions and no pretest data was collected to measure risk perception before randomization. However, there were no significant demographic differences found between high and low risk groups so all participants were considered equally comparable.

There were no demographic differences found between completers and non completers in this study with the exception of age. The average age of responders was 51.years compared to 56.6 years for non completers. The majority of the non completers were considered high risk, as opposed to being average risk (8 participants as opposed to 5 participants, respectively). The risk of breast cancer increases with age (ACS, 2007) so consequently it stands to reason that since there were more high risk completers than average risk completers that there would be an increased age difference to reflect their respective risk status.

The attrition rate in this study was 14%, well within the acceptable 20% standard, which is especially impressive considering this was a longitudinal study as opposed to a cross-sectional study. Typical response rates for mailed questionnaires are usually less than 65% (Polit & Beck, 2004). Response rates may have been higher due to the fact that many of the participants were employees of the hospital; making it easier to track them down.

External Validity

This study is one of the first studies to demonstrate support for protection motivation theory within a clinical setting for breast cancer in women; however, it is limited in its ability to generalize findings beyond women or breast cancer. And since the sample in this study consisted primarily of Caucasian women, the findings are not generalizable to other ethnicities.

Care must be taken when interpreting the results, as it is possible that the type of information given to participants may not have been as effective as the amount of time the health care provider spent with each participant. Individuals who received specific health information spent more time with the health care provider since there was more information to discuss than those individuals who received general health information. It is also possible that the health care provider may have been more influential in effecting a behavioral change than the information itself.

Reliability and Validity

The instruments selected for use in this study failed to adequately operationalize or measure perceived severity or response efficacy. It would be interesting to learn if either of these two variables was effectively manipulated and could further explain the variance in exercise behavior. An additional instrument that measures three of the above four variables has been commonly used in protection motivation theory literature. The instrument, which was specifically used by Courneya and Hellsten (2001) and Graham et al. (2006) employed three seven-point items designed to measure perceived vulnerability, perceived severity, and response efficacy related to colon cancer. Unfortunately, this tool was not available to the researcher at the time of this study.

Implications of the Findings

The present study examined the effects of risk and self-efficacy in the initiation and adoption of moderate to vigorous exercise and tested the theory of protection motivation. Findings from this study can be used to guide evidence-based practice and/or outcomes relevant to healthcare aimed at reducing breast cancer risk in women.

Theoretical Implications

This study attempted to test the main framework of protection motivation theory within a healthcare setting. Interventions were designed to generate intention and behavioral change. The findings in this study offered only modest support for the coping appraisal component of protection motivation theory in predicting exercise behavior. However, since risk could not be ethically manipulated, it may be that participants did not fully appreciate their risk. Prior studies have successfully manipulated all four components of protection motivation theory (perceived vulnerability, perceived severity, response efficacy, and self-efficacy) but the studies were conducted in a laboratory setting rather than a clinical setting. Courneya and Hellsten (2001) successfully manipulated all four components of protection motivation, but in school setting using phony information and did not measure actual behavior, only motivation to exercise. Graham, Prapavessis, and Cameron (2006) used factual information to manipulate the main components of protection motivation, but in a school setting, and like the present study, failed to manipulate the threat appraisal components. This study is one of the first studies known to demonstrate support for protection motivation theory within a clinical setting for breast cancer in women. However, the researcher is limited to her ability to generalize findings beyond women or breast cancer.

And while threat appraisal failed to predict exercise behavior in the present study, threat appraisal has been shown to be a necessary, albeit not sufficient condition in predicting protective health behavior (Rippetoe & Rogers, 1987). Previous reviews of protection motivation theory have found that the coping appraisal component has greater predictive validity than the threat appraisal component (Milne et al., 2000). According to

Schwarzer (1992; 2001), an individual forms an intention to change based upon perceived vulnerability and perceived severity of a threat, as well as outcome expectancies and self-efficacy. Perceived susceptibility and/or perceived risk, as well as self-efficacy have been shown to be critical factors in motivating individuals to adopt health protective behaviors, and as such, are central components of many health behavior models (Bandura, 1986; Dishman & Buckworth, 2001; Graham, Prapavessis, & Cameron, 2006; Rippetoe & Roger, 1987). However, self-efficacy appears to be the overriding variable in predicting motivation and protective health behavior (Schwarzer & Fuch, 1996; Stutts, 2002; Wurtele & Maddux, 1987). Theoretical behavioral models all seem to converge on the notion that intention is the key determinant of behavior. Findings from a recent meta-analysis suggest that intervention is most likely to be successful in effecting behavioral change if the treatment is based upon either protection motivation theory (Milne et al., 2000; Rogers, 1983) or the theory of planned behavior (Fishbein & Ajzen, 1975), uses social support or goal incentives, and is presented by a health educator. (Webb & Sheeran, 2006).

Several health belief models have been shown to effectively predict health behavior. The theoretical determinant in each of these models is self-efficacy and as such, is the primary indicator of exercise participation (Stanley & Maddux, 1986). When protection motivation theory was combined with self-efficacy theory, both self-efficacy and response-efficacy predicted a person's intentions to perform health-enhancing behavior, although outcome value (otherwise known as perceived social value) had no significant effect on behavioral intentions. While Ajzen's theory of planned behavior has dominated the field of research in predicting physical activity (Hagger et al.2001) based on three constructs (perceived behavioral control, subjective norm, and attitude), perceived behavioral control, which is regarded as synonymous with Bandura's (1997) self-efficacy construct (Azjen, 1998), was seen as the only significant predictor of exercise behavior (Armitage, 2005). Perceived behavioral control was also found to be the key theoretical determinant for exercise behavior that was mediated by a physician's recommendation to exercise among breast cancer survivors (Jones, Courneya, Fairey, & Mackey, 2005).

Given that self-efficacy has been shown to be the most powerful predictor of exercise intentions (Wurtele & Maddux, 1987) it stands to reason that we need to place more emphasis on developing a model of health enhancement as opposed to disease prevention (Maddux & Rogers, 1983; Rogers, 1983; Corwyn et al., 1999; Netz et al., 2004; Stanley & Maddux, 1986). In the present study, only 15% of the variance was explained by self-efficacy; clearly more research is needed to determine the effects of other variables on health behavior decision-making. According to the health belief model (HBM), health behaviors are determined by an individual's perception of a threat posed by a health problem and the value of a behavior taken in reducing this threat, weighed against the perceived benefits and/or barriers of taking action (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977; Rosenstock, 1974). Corwyn & Benda (1999) showed perceived benefits of exercise to be the strongest predictor of exercise, and modeling others who regularly engage in exercise, the second strongest predictor of exercise, accounting for 41.8% of the total variance in exercise behavior, suggesting that health care support can play a major role in exercise motivation. This lends further support to the role that health care providers can serve in facilitating healthy behavioral change.

Facilitating intrinsic motivation (activity participation for the sake of enjoyment) to promote well-being is considered the critical factor in promoting exercise adherence (Ryan & Deci, 2000). Health care providers are in a unique position to provide knowledge and appreciation for physical activity and facilitate perceptions of personal achievement, autonomy, and self-confidence to promote well-being and realistic goal setting to enhance motivation to initiate and maintain a healthy lifestyle as opposed to preventing disease (Mears & Kilpatrick, 2008).

Research Implications

This study suggests the need for future research to establish a better way to enhance self-efficacy beliefs. Individuals motivate themselves and plan their actions using forethought to anticipate likely outcomes of future actions, setting personal goals that are influenced by self-appraisal of their capabilities and likelihood of success (Bandura, 1989). Enhancing the belief in one's ability to perform an action encourages problem solving and an effective coping response (Rippetoe & Rogers, 1987). An individual must be both efficacious and have the necessary incentive to motivate behavior (Bandura, 1986). There have been few studies using health education manipulations to enhance self-efficacy. Further research is needed to determine the quality and quantity of information necessary to positively effect a change in behavior.

There are many psychological factors that affect the impact of breast cancer risk counseling and the performance of health protective behaviors. While health information about risk may be effective in enhancing intention to change, such information may be less useful in predicting actual behavioral change. Perhaps women require additional counseling and time for processing before they not only become aware of the threat, appreciate its severity, but finally take ownership of their own personal risk. And perhaps it takes more than one counseling session and requires additional knowledge and education. This may be especially applicable for those women who have a family history of breast cancer.

Future improvements in design and measurement should take into consideration the impact that a health care provider can have on promoting lifestyle changes to reduce breast cancer risk. Effectively manipulating and measuring all four components of protection motivation theory (perceived vulnerability, perceived severity, self-efficacy, and response efficacy) could make a difference in predicting exercise behavior. Although, according to Arimtage and Conner (2000), motivational models such as protection motivation theory (Rogers, 1983) provide an incomplete account of the variance of health behavior, and yet multi-stage models such as the health action process approach (Schwarzer, 1992) tend to conceptualize health behaviors in terms of discrete stages without offering any explanations about how changes in attitudes, intentions, and behavior occur. Efforts should be given to designing a more comprehensive theoretical model that incorporates all the possible variables that are important to promoting health behavioral changes.

Applied Implications

Cancer prevention can motivate women to exercise, and as such, this study is one of the few studies to demonstrate support for protection motivation theory within a clinical setting for breast cancer. The study findings are limited to the target population which consisted of mostly Caucasian, urban, white women who came into the Breast Care Center/Mammography department at St. Luke's Hospital.

The results were rather disappointing in that the threat appraisal component did not predict exercise behavior in this study. Findings suggest that while risk may be an attention getter, it is not enough in and of itself, to motivate women to take action. Altering perceptions of susceptibility for breast cancer remains a daunting task for health care providers, and as such, needs considerable tweaking. Fortunately, self-efficacy made a moderate contribution to the prediction model, suggesting the need for further intervention. The potential role of the health care provider in promoting exercise is yet to be determined. As previously demonstrated, individuals will follow through with self-care activities more readily if their concerns are understood, are taught about their health threat along with specific health promoting behaviors, and encouraged to participate in their own care (Cameron, 1996; DiMatteo, et al., 1993; Phister-Minogue, 1993). This study provides support for the potential role of the health care provider in changing actual behavior and as such, warrants further research using interventions which will promote self-confidence and perceptions of performance mastery. Individuals need positive feedback to enhance self-efficacy and promote exercise behavior. And most important, individuals need education and emotional arousal regarding the benefits of exercise in order to promote good health and reduce the health risks associated with a sedentary lifestyle (McAuley & Blissmer, 2000).

Conclusions and Recommendations

The potential benefits of exercise and it implications for improving long term mortality outcomes deserves more attention, especially as a possible vehicle in the prevention of breast cancer. Self-efficacy plays a critical role in determining both protection motivation and health behavior and as such, offers insight for future research.

Findings from this study indicate the need for nursing interventions designed to improve self-efficacy and enhance motivation to elicit participation in lifestyle risk reduction behaviors, especially for women who are predisposed to breast cancer. While health information and accurate exercise knowledge were shown to enhance self-efficacy and exercise behavior, more studies are needed to confirm these findings. Equally important is the method of delivery (e.g. handout, video, monthly newsletter, support group, website) used to encourage exercise participation. Further research is needed to see if it makes a difference as to mode and method of delivery. It is also important to understand whether or not it makes a difference if the intervention is delivered individually or on a group basis and by whom (e.g. health care provider or assistant). A prospective study is needed to determine if health care providers who provide teaching along with written health information can be more instrumental in affecting intention and behavioral change than simply providing written health information.

Altering perceptions of susceptibility for breast cancer remains a major challenge for health care providers. Causal relationships can be very complex and a single quantitative study is unlikely to capture every component affecting behavioral change. In the present study, neither Gail risk nor perceived susceptibility was enough to motivate women to exercise. And even though women who were at higher risk of developing breast cancer were more likely to perceive themselves as being at higher risk, it was not enough to affect behavioral change. Perhaps women need more education regarding risk before they are willing to take action. A prospective trial that measures risk perception and behavioral intentions before and after each educational session may offer insight into how education affects risk perception and exercise behavior. In order to gain a better understanding of how perceived susceptibility changes in relationship to a woman's Gail risk perception, it may be helpful to administer the susceptibility test as a pre-test, immediate post-test, and then three months later to determine if risk may be better associated with intention than behavior.

Until recently, nursing research has been dominated by quantitative studies based on research findings from rigorous investigations reflecting evidence-based practice. Future research is needed to explore the accuracy of women's perceptions of breast cancer risk using a qualitative approach. A qualitative study may help to shed light on how women perceive their risks after Gail model risk assessment and how risk perception interacts with health-related behavioral change to further test the theory of protection motivation. A follow-up study may be helpful to explore the long-term effects of the experimental manipulations used in this study to promote healthy lifestyle change. More could be learned by following the high risk women to see if they have made any lifestyle changes in an attempt to decrease their risk.

Incidentally noted was the extremely low attrition rate in the present study, suggesting the need for future research to determine if this method is reproducible in other settings. It would also be interesting to learn if newer technology as in e-mail correspondence may be more effective in obtaining feedback from participants as opposed to mailed questionnaires.

Since the target population in this study was Caucasian, urban, white women, future research should explore other accessible populations to determine if findings would be similar. Efforts should be made to include more than one institution, targeting Caucasian and African Americans, as well as other minorities to gather data from urban, rural, and metropolitan areas as other populations may be influenced differently by the cognitive components of protection motivation theory.

Finally, consideration should be given to exploring other theories and/or combining protection motivation theory with other models. In the present study, only 15% of the variance was explained by self-efficacy, suggesting the need for further research to determine the effects of other variables on health behavior decision-making. Path analysis relies on multiple regression as a method of studying causal effects among variables, both in the model and outside the model (Polit & Beck, 2004), and as such, could be used to explain exercise behavior. Since many of the health behavioral models have a number of variables in common, path analysis using regression procedures and competitive theory testing could be used to assess relationships between other variables (Ching-Hsing, Wang, McCubbin, Zhang, & Inouye, 2007; Finfgeld et al., 2003). There are many similarities between the health belief model and protection motivation theory. An exploratory secondary analysis using competitive theory testing may be helpful to address the social context of health behavior to increase our understanding of the complex relationship between self-efficacy and exercise behavior by including other variables other than risk. There are many similarities between health models, suggesting the need to pull together complementary hypotheses across theoretical frameworks to look at the redundancy of models using discriminant function analysis to eliminate overlapping constructs.

Understanding the meaning of the study findings is dependent upon the logic of the theoretical framework and how it relates to nursing practice. Concepts are said to be the building blocks of theory and as such, theory should be developed in concert with the research questions and directly linked to problems in an effort to provide evidence-based nursing practice. Such evidence-based research can aid health care practitioners in developing appropriate interventions aimed at reducing breast cancer risk in women.

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APPENDIX A

Breast Cancer Risk Reduction Study

The Breast Cancer Risk Reduction Study, sponsored by St. Luke's Hospital Breast Care Center, will be an attempt to learn more about exercise motivation and breast cancer risk reduction in women. It is a three month study involving women who are receiving services in the Breast Care Center/Mammography facility at St. Luke's Hospital.

You are eligible for the study if you:

- *Have never had breast cancer*
- *Are between the ages of 40 and 65*
- *Are not currently exercising more than 2 days/week*
- *Are able to participate in regular physical activity without any medical or physical limitations*

If you join the study, you will be asked to:

- Complete a self-rating depression scale prior to enrollment to determine your eligibility (about 5 minutes)
- Complete a Gail model breast cancer risk assessment with the assistance of the researcher using an interactive computer tool (about 20 minutes)
- Complete a brief demographic questionnaire (about 5 minutes)
- Complete three short follow-up questionnaires which will be mailed to you in three months (about 15 minutes)

Participation is voluntary and confidential. The information provided will be used in doctoral research; you will not be identified.

To find out more or to enroll in **The Breast Cancer Risk Reduction Study,** please let the receptionist in the Breast Care Center/Mammography Center know and you will be directed to **Maureen Wood**, the primary investigator, or call her at **(314-205-6046)** to make an appointment.

APPENDIX B

Zung Self-Rating Depression Scale (SDS)

For each item below, please place a check mark (√) in the column which best describes how often you felt or behaved this way during the past several days

Place check mark (√) in correct column.	A little of the time	Some of the time	Good part of the time	Most of the time
1. I feel down-hearted and blue.				
2. Morning is when I feel the best.				
3. I have crying spells or feel like it.				
4. I have trouble sleeping at night.				
5. I eat as much as I used to.				
6. I still enjoy sex.				
7. I notice that I am losing weight.				
8. I have trouble with constipation.				
9. My heart beats faster than usual.				
10. I get tired for no reason.				
11. My mind is as clear as it used to be.				
12. I find it easy to do the things I used to.				
13. I am restless and can't keep still.				
14. I feel hopeful about the future.				
15. I am more irritable than usual.				
16. I find it easy to make decisions.				
17. I feel that I am useful and needed.				
18. My life is pretty full.				
19. I feel that others would be better off if I were dead.				
20. I still enjoy the things I used to do.				

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APPENDIX C

St. Luke's HOSPITAL

232 S. Woods Mill Road
Chesterfield, MO 63017

[] Adult [] Minor

IRB #

RESEARCH PARTICIPANT INFORMED CONSENT AND PRIVACY AUTHORIZATION FORM

Participant: ______________________ **Date:** ______________________

Principal Investigator: Maureen Wood **Telephone#:** 314-205-6046

Sponsor: I am a doctoral candidate conducting this project as part of my coursework to complete the degree of PhD at the University of MO-St. Louis and my supervising professor is Dr. Donna Taliaferro. Please feel free to contact her at 314-516-6069 if you have any questions.

STUDY TITLE: Exercise Motivation for Breast Cancer Risk Reduction

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1. What you should know about this study:

- You are being asked to join a research study.
- This consent form explains the research study and your part in the study.
- Please read it carefully and take as much time as you need.
- Please ask questions at any time about anything you do not understand.
- You are a volunteer. If you join the study, you can change your mind later. You can decide not to take part or you can quit at any time. There will be no penalty or loss of benefits if you decide to quit the study.
- We may learn things during the study that might make you want to stop being in the study. If this happens, we will tell you about it. You can then decide if you want to stay in the study.

2. Why is this research being done?

This research is being done to learn more about how risk and health information will affect your desire to exercise. You will be told what your chance is of getting breast cancer in the next five years. You will be given either written general or specific health information to read and take home with you. This information will tell you how to reduce your risk of getting breast cancer. Woman, ages 40 to 65 years, who exercise no more than two times a week may join. You may not have breast cancer or have any mental or physical limitations.

3. How many people will take part in the study?

There will be about 100 participants who are expected to take part in this research study.

4. What will happen if you join this study?

If you agree to be in this study, we will ask you to do the following things:

- Complete a self-rating depression scale prior to enrollment to determine your eligibility.
- Complete an information sheet that will ask you questions about your age, race, weight, height, if married, education, and job.
- Participate in a breast cancer risk assessment with the principal investigator. You will be told what your risk of developing breast cancer is over the next five years. Your risk will be compared to the average woman and you will be given a score. This score will tell you if you are considered to be at high or average risk for developing breast cancer over the next five years.
- You will then be randomly assigned to one of two treatments. A coin will be flipped ahead of time to help determine which treatment you will receive. You will either receive general written information about breast cancer risk and/or specific written information to help reduce your risk.
- In three months you will mailed a packet that contains three questionnaires and a self-addressed stamped envelope. You will be given written instructions and asked to complete the packet. Upon completion, you will be asked to mail it back to St. Luke's Hospital.

5. How long will I be in the study?

We think you will be in the study for three months.

6. What are the risks or discomforts of the study?

What are my risks of joining the study?

- After being told your breast cancer risk, your risk for depression may increase. The Department of Pastoral Care is available to meet with you at any time to provide pastoral care and can help arrange further counseling services through Social Services at St. Luke's Hospital. You may be referred to your primary doctor or a mental health professional for treatment of depression. You may also schedule an appointment in the Breast Care Center or meet with a genetic counselor at St. Luke's Hospital. A list of providers of counseling services is available upon request. Contact information for the Department of Pastoral Care will be given to you.
- Sometimes exercise can hurt you, especially if you are not in good health. It is important to check with your doctor before you start exercising. If you are injured while exercising, you will need to call your doctor as soon as possible.
- You may call the primary investigator at any time if you have a problem.

What are the risks associated with continuing standard treatment?

- There are no known risks associated with continuing standard treatment.

Are there any other risks that might result from your participation in this study?

- There is always a slight risk for the loss of confidentiality. Every attempt will be made to protect your privacy. You will be identified by a number and only the primary investigator will have access to this information.
- There are no financial risks that may result from your participation.
- You may experience a few minor physical discomforts with exercise as you adjust to your routine. Start out slowly and pace yourself. Do not over exert yourself.

7. Are there benefits to being in the study?
If you take part in this study, you may help others in the future.

8. What are your options if you do not want to be in the study?
You do not have to join this study. If you do not join, your care at St. Luke's Hospital will not be affected.

9. Will it cost you anything to be in this study?
Taking part in this study may lead to added costs to you or your insurance company or your managed care plan. You will be charged in the usual and regular manner. You may not automatically be provided with reimbursement for medical care by your insurance company or managed care plan, in which case you will be responsible for such charges. Please ask about any expected added costs or insurance problems.

In case of illness or complication, because of treatment on this study, you will be offered emergency medical treatment, and continuing medical care including hospitalization, as necessary. This treatment will not be free, but must be paid for in the same way as your regular medical care is paid.

10. Will you be paid if you join this study?
You will be sent a $5 gift card along with the questionnaire packet that will be mailed to you in three months at completion of the study. No funds have been set aside to pay you if you are injured.

11. Can you leave the study early?
- You can agree to be in the study now and change your mind later.
- Leaving this study early will not stop you from getting regular medical care.

12. Why might we take you out of the study early?
You may be taken out of the study if:
- Staying in the study would be harmful.
- You become pregnant.
- There may be other reasons to take you out of the study that we do not know at this time.

13. How will your privacy be protected?
Data from this study may be published, but individual patients will not be identified in these publications. Efforts will be made to keep your personal information confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law.

The principal investigator, other researchers and persons working on the project and St. Luke's Hospital will strive to protect confidentiality of your Protected Health Information (PHI) according to regulations of the Health Insurance Portability and Accountability Act of 1996 (HIPAA). PHI is health information that identifies you. To take part in this research, you must give the research team permission to use and disclose (share) your PHI for the study explained in this consent form.

In addition to health information that may be created by the study, the research team may access the following sources of your health information to conduct the study: such as your name, address, date of birth, and other information.

Organizations that may inspect your medical record, including identifying information and/or copying your research records for quality assurance and data analysis include the following groups:

- The Food and Drug Administration (FDA)
- Office of Human Research Protection (OHRP)
- Department of Health and Human Services (DHHS)
- Federal or state government agencies involved in keeping research safe for people
- St. Luke's Hospital Institutional Review Board
- [List other agencies that will have access]

If your record is used for such purposes, it will be done under conditions that will protect your privacy to the fullest extent possible consistent with laws relating to public disclosure of information and the law-enforcement responsibilities of the agency.

Once your health information is shared with someone outside of the research team, it may no longer be protected by HIPAA.

If you decide not to sign this form, it will not affect
- your treatment or the care given by your health provider.
- your insurance payment or enrollment in any health plans.
- any benefits to which you are entitled.

However, it will not be possible for you to take part in the study.

If you sign this form:
- You authorize the use of your PHI for this research
- Your signature and this form will not expire as long as you wish to participate.
- You may later change your mind and not let the research team use or share your information (you may revoke your authorization).
- To revoke your authorization, send a letter in writing to your study doctor.
    - **If you revoke your authorization:**
        - The research team may only use and share information already collected for the study.
        - Your information may still be used and shared if necessary for safety reasons.
        - You will not be allowed to continue to participate in the study.

14. What are my rights if I take part in this study?

Taking part in this study is your choice. You may choose either to take part or not to take part in the study. If you decide to take part in this study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your regular benefits. Leaving the study will not affect your medical care. You can still get your medical care from our institution.

We will tell you about new information or changes in the study that may affect your health or your willingness to continue in the study.

In the case of injury resulting from this study, you do not lose any of your legal rights to seek payment by signing this form.

15. What other things should you know about this research study?

a. What is the Institutional Review Board (IRB) and how does it protect you?

The St. Luke's Hospital Medicine IRB is made up of:

- Doctors
- Nurses
- Ethicists
- Non-scientists
- and people from the local community.

The IRB reviews human research studies. It protects the rights and welfare of the people taking part in those studies. You may contact the IRB if you have questions about your rights as a participant or if you think you have not been treated fairly. The IRB office number is (314) 205-6577. You may also call this number for other concerns or questions about the research.

b. What do you do if you have questions about the study?

Call the principal investigator, Maureen Wood, NP at 314-205-6046. If you cannot reach the principal investigator or wish to talk to someone else, call the IRB office at (314) 205-6577.

c. What should you do if you are injured or ill because of being in this study?

Call 911, if you have an urgent medical problem related to your taking part in this study.

Call the principal investigator, Maureen Wood, NP, at 314-205-6046, if you think you are injured or ill because of this study.

Medical care at St. Luke's Hospital is open to you as it is to all sick or injured people. St. Luke's Hospital does not have a program to pay you if you are hurt or have other bad results from being in the study. The costs for any treatment or hospital care would be charged to you or your insurance company.

d. What happens to Data that are collected in the study?

Date from this study may be published, but individual patients will not be identified in these publications. Efforts will be made to keep your persona information confidential.

If you join this study:

- St. Luke's Hospital and/or its outside partners in this research will own these data.
- St. Luke's Hospital and/or its outside partners in this research may only use materials or data that identify you for future research with your consent or IRB approval.

16. What does your signature on this consent form mean?

Your signature on this form means that:

- You understand the information given to you in this form
- You accept the provisions in the form
- You agree to join the study
- You will follow the study rules as described in this consent form

You will not give up any legal rights by signing this consent form.

WE WILL GIVE YOU A COPY OF THIS SIGNED AND DATED CONSENT FORM

SIGNATURES

I have read this consent form, asked questions, received answers concerning areas I did not understand, and I understand what I have read and have been given. I willingly give my consent to participate in the study title: Exercise Motivation for Breast Cancer Risk Reduction

My signature on this consent form means that I agree to take part in this study and agree to the use of my health information as described in this consent.

Participant ______________________________ Date __________________

Witness ________________________________ Date __________________

I have explained this informed consent to the participant or to his/her legal representative or guardian on the date set forth below.

Physician/Researcher __________________________ Date ___________

Do not sign after the expiration date of: ________

NOT VALID WITHOUT THE IRB STAMP OF APPROVAL

Initial IRB Consent Approval Date:

APPENDIX D

DEMOGRAPHIC INFORMATION (Please answer the following questions):

TODAY'S DATE: ________________

DATE OF BIRTH: ________________

PRESENT AGE: ______________

HEIGHT: ______________

WEIGHT: ____________

MARITAL STATUS (Please circle one of the following):

(1) Single (2) Married (3) Divorced (4) Separated (5) Widowed

ETHNICITY (Please circle which of the following ethnic groups you belong to):

(1) White (2) Black (3) Hispanic (4) Asian (5) Other

EDUCATION (Please circle highest level of completion):

(1) Grade school (2) High school (3) Undergraduate (4) Graduate

PRESENT JOB CLASSIFICATION: __________________________________

STUDY USE ONLY: RESEARCH PARTICIPANT # ________________

APPENDIX E

The Gail Model

1. Does the woman have a medical history of any breast cancer or of ductal carcinoma in situ (DCIS) or lobular carcinoma in situ? (Yes or No)
2. What is the woman's age? This tool only calculates risk for women 35 years or older. (<35, 35 – 85)
3. What was the woman's age at the time of her first menstrual period? (Unknown, 7 to 11, 12 to 13, > = 14)
4. What was the woman's age at the time of her first live birth of a child? (unknown, no births, <20, 20 to 24, 25 to 29, > = 30)
5. How many of the woman's first-degree relatives – mother, sisters, daughters – have had breast cancer? (Unknown, 0, 1, >1)
6. Has the woman ever had a breast biopsy? (Unknown, No, Yes)
    6a. How many breast biopsies (positive or negative) has the woman had? 1, >1)
    6b. Has the woman had at least one breast biopsy with atypical hyperplasia? (Unknown, No, Yes)
7. What is the woman's race/ethnicity? (White, Black, Hispanic, Asian or Pacific Islander, American Indian or Alaskan Native, Unknown)

APPENDIX F

Breast Cancer Susceptibility Subscale

These questions are about your beliefs related to breast cancer. Please circle the number for each statement that most closely matches your beliefs related to breast cancer.

Scale: 1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

1. It is extremely likely I will get breast cancer in the future.

   1 2 3 4 5

2. I feel I will get breast cancer in the future.

   1 2 3 4 5

3. There is a good possibility I will get breast cancer in the next 10 years.

   1 2 3 4 5

4. My chances of getting breast cancer are great.

   1 2 3 4 5

5. I am more likely than the average woman to get breast cancer.

   1 2 3 4 5

APPENDIX G

Confidence (Self-Efficacy)

Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other activity in which the exertion is at least as intense as these activities.

Circle the number that indicates how confident you are that you could be physically active in each of the following situations:

Scale (1 = not at all confident 2 = slightly confident 3 = moderately confident 4 = very confident 5 = extremely confident).

1. When I am tired	1	2	3	4	5
2. When I am in a bad mood	1	2	3	4	5
3. When I feel I don't have the time	1	2	3	4	5
4. When I am on vacation	1	2	3	4	5
5. When it is raining or snowing	1	2	3	4	5

APPENDIX H

Godin Leisure-Time Exercise Questionnaire (LTEQ)

Considering a 7-Day period (a week), how many times on average do you do the following kinds of exercise for **at least 15 minutes (strenuous) or 30 minutes (moderate)** during your free time (write on each line the appropriate number)?

Times Per Week

A. STRENUOUS PHYSICAL ACTIVITY
(heart beats rapidly, sweating) ____________

(e.g., running, jogging, hockey, soccer, squash, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, vigorous aerobic dance classes, heavy weight training)

B. MODERATE PHYSICAL ACTIVITY
(not exhausting, light perspiration) ____________

(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, Badminton, easy swimming, alpine skiing, popular and folk dancing)

C. MILD PHYSICAL ACTIVITY
(minimal effort, no perspiration) ____________

(e.g., easy walking, yoga, archery, fishing, bowling, Lawn bowling, shuffleboard, horseshoes, golf, snowmobiling)

Considering a 7-Day period (a week), during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)? Circle your answer below.

Often (at least 3 times/week) Sometimes (2 times/week) Never/rarely

APPENDIX I

Breast Cancer Facts

Breast cancer risk factors:

- Women of all ages, but especially those who are age 50 and older
- Women with a family history of breast cancer such as a mother, sister, or daughter, especially before the age of 40
- Women with a personal history of breast cancer or atypical hyperplasia on biopsy
- Never having children or having a first child after the age of 30
- First menstrual period before age 12 or late menopause after age 55
- Dense breast tissue
- Menopausal use of hormone replacement therapy
- Postmenopausal obesity (20 percent over a person's ideal body weight)
- Physical inactivity
- Women who drink more than one alcohol drink a day

Signs and symptoms of breast cancer:

- Any new lump, thickening, or change in or around the breast or underarm area
- Swelling or a change in the size or shape of the breast
- Skin irritation or pain, redness or heat, rash, dimpling or puckering of the skin
- Nipple tenderness, inversion, scaly skin or erosion, discharge from the nipple
- Swollen underarm lymph nodes

Risk factors that you can control:

- Participate in regular physical activity, regardless of intensity. Walk, swim, garden, dance or ride your bike, and use the stairs whenever you can. Become involved in activities that you enjoy.
- Maintain a healthy body weight and avoid obesity, especially after menopause.
- Drink alcohol in moderation, if at all. Do not consume more than one drink a day.

Early detection of breast cancer:

- Annual mammogram (age 40 and older)
- Annual clinical breast examination (every 3 years age 20-39)
- Monthly breast self-examination (optional)

Sources: American Cancer Society and the American Institute of Cancer Research

APPENDIX J

Exercise and Breast Cancer Risk Reduction

Current guidelines:
By maintaining a healthy body weight and regular physical activity, regardless of intensity, the risk of breast cancer can be significantly reduced. This benefit may be due to the effects of physical activity and lower levels of estrogen production in women, linked to lower incidence of breast cancer. Current recommendations include 30 minutes or more a day of moderate activity five or more times a week and/or 15-20 minutes a day of vigorous activity at least three times a week. The physical activity does not need to be done continuously, but can be combined to add up to 15 minutes of vigorous or 30 minutes of moderate activity (two 15 minute increments) daily in order to reduce your breast cancer risk. The following chart lists examples of moderate and vigorous activity.

Examples of moderate and vigorous physical activity:

Activity Type	Moderate Activities (150-350 calories/hour)	Vigorous Activities (more than 350 calories/hour)
Exercise and Leisure	Walking 15-20 minutes/mile, bicycling (5 mph), ballroom dancing, horseback riding, rowing, yoga, tai chi	Jogging (10 minute mile), stair climbing, bicycling (13 mph), circuit weight training, aerobic dance, martial arts, jumping rope, swimming, hiking
Sports	Volleyball, golfing (without a cart), baseball, doubles tennis, downhill skiing	Soccer, singles tennis, racquetball, basketball, cross-country skiing
Home Activities	Mowing the lawn, vacuuming carpet, cleaning windows, mopping floors	Moving furniture, shoveling snow, chopping wood, carrying and hauling, scrubbing floors
Occupational	Walking briskly at work	Heavy manual labor

How to get started:

- Plan ahead and set time aside a regular time to exercise into your schedule.
- Start slowly and gradually progress until you reach the current recommendations.
- Choose an activity that you can easily incorporate into your lifestyle.
- Exercise with a friend or partner to stay motivated.
- Change activities frequently to improve fitness and to avoid becoming bored.
- Set realistic weekly goals and frequently reward yourself for remaining active.
- Keep a fitness diary to record your progress.
- Remember that exercise becomes easier over time. It may take up to six months to adjust to a new routine.
- Maintain a healthy body weight and strive for a body mass index of less than 25.

Sources: American Cancer Society, American Institute of Cancer Research, and the American College of Sports Medicine

APPENDIX K

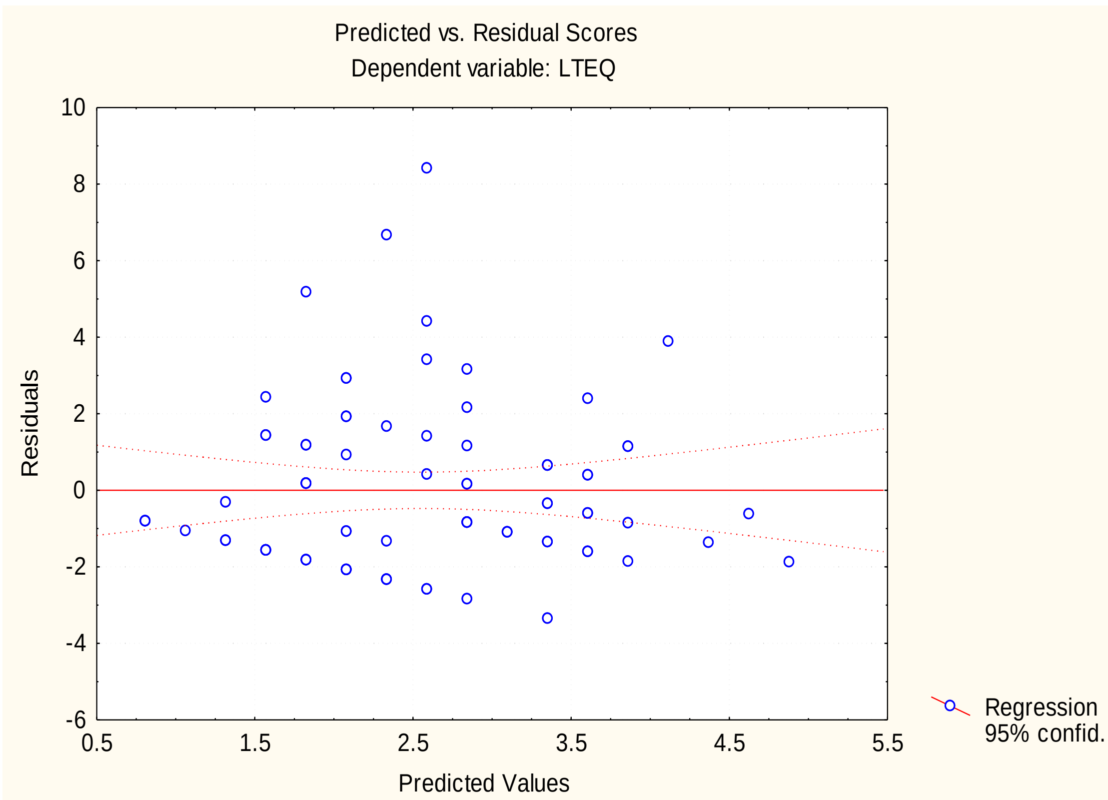

Figure K1. Scatterplot of standardized residuals: LTEQ vs. self efficacy.

APPENDIX L

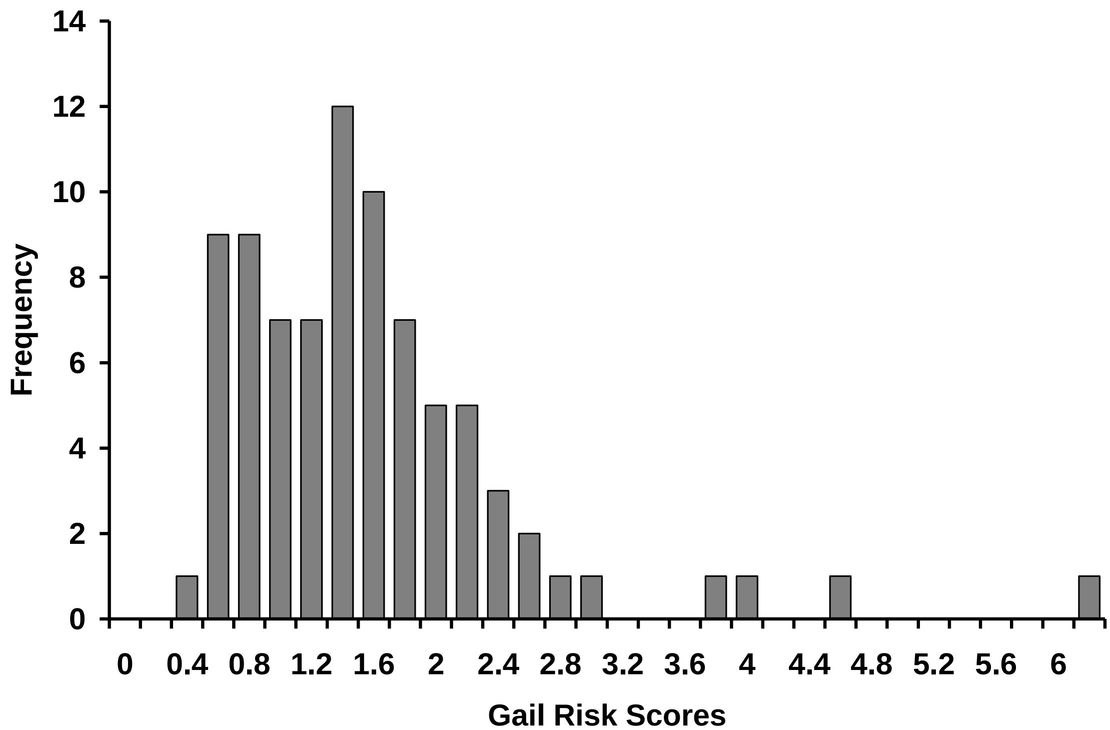

Figure L1. Histogram of Gail risk scores. Gail risk model scores followed a normal distribution with a mean and standard deviation of 1.73 ± 0.941 respectively.

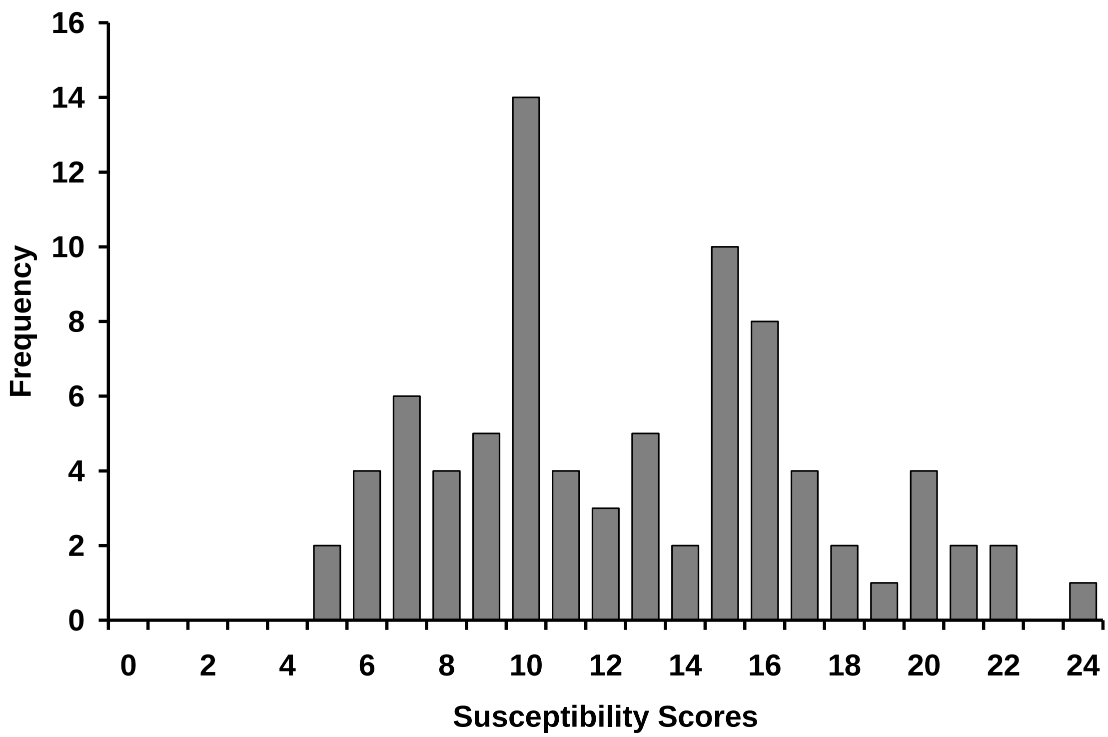

Figure L2. Histogram of susceptibility scores. Susceptibility model scores followed a normal distribution with a mean and standard deviation of 12.7 ± 4.59 respectively.

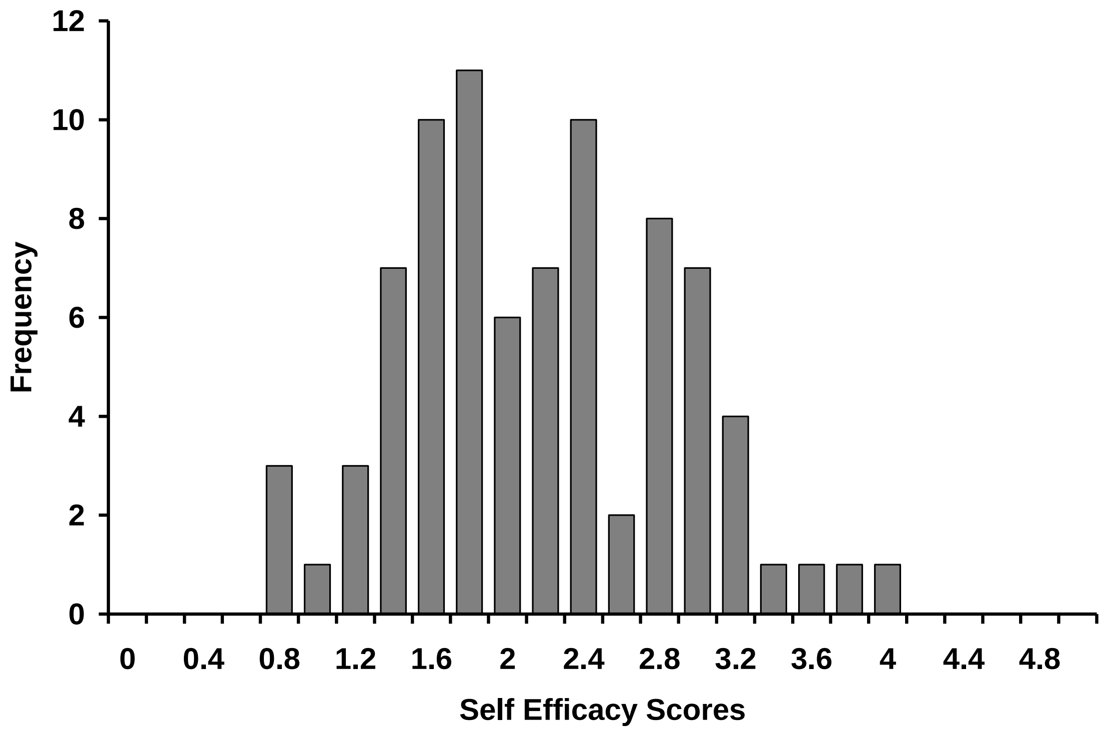

Figure L3. Histogram of self-efficacy scores. Self-efficacy model scores followed a normal distribution with a mean and standard deviation of 2.37 ± 0.712 respectively.

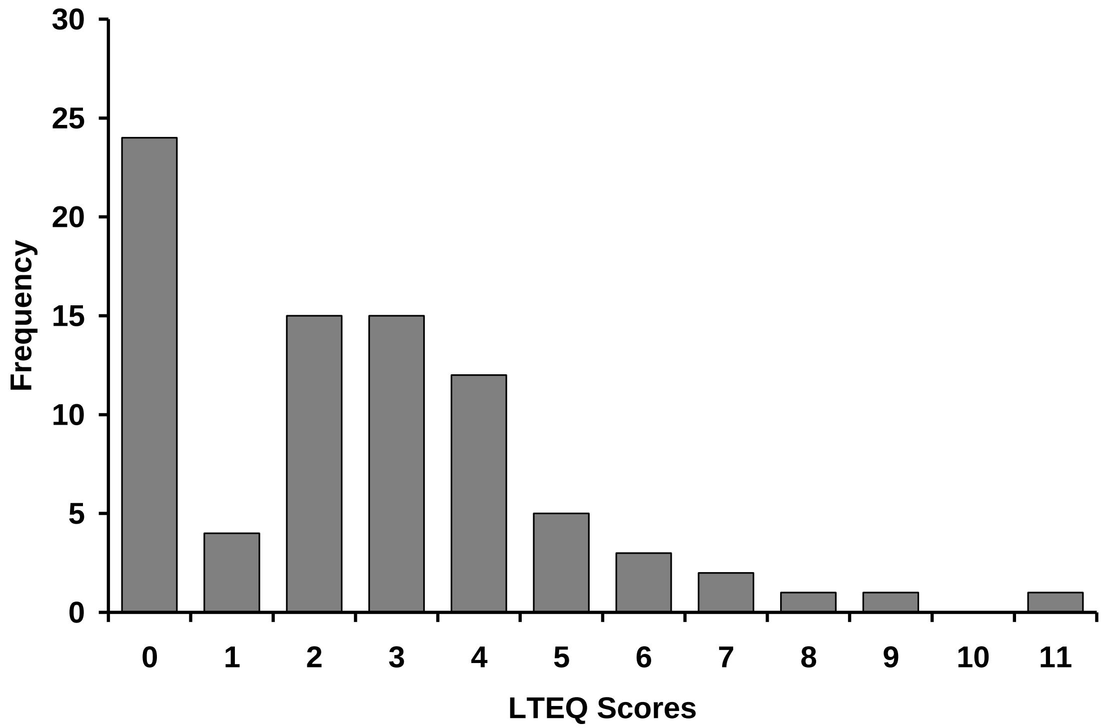

*Figure L4***.** Histogram of LTEQ scores. LTEQ scores followed a normal distribution with a mean and standard deviation of 2.55 ± 2.33 respectively.