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Predicting fear of recurrence and protective health behaviors using protection motivation theory

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Predicting Fear of Recurrence and Protective Health Behaviors

Using Protection Motivation Theory

by

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ABSTRACT

Prior research suggests that fear of cancer recurrence is very common among cancer survivors. This study examined the extent to which Protection Motivation Theory variables of threat appraisal and coping appraisal accounted for differences in fear of recurrence and performance of health behaviors in cancer patients who recently completed treatment. It was hypothesized that greater fear of recurrence would be related to a combination of high threat appraisal and low coping appraisal. Also, it was hypothesized that higher rates of health behaviors would be related to higher threat appraisals for cancer recurrence and higher coping appraisals for reducing risk of recurrence by improving diet or exercising. A sample of 155 early-stage breast cancer patients (mean age = 59 years) who completed surgery, chemotherapy, and/or radiotherapy between 6-24 months previously (mean = 12 months) completed measures of fear of recurrence, threat appraisal (perceived risk and severity of a potential cancer recurrence), fruit and vegetable intake in the past month, exercise for the past week, and coping appraisal (perceived response efficacy and self-efficacy to perform diet and exercise recommendations to reduce recurrence risk). Basic demographic and clinical information was also collected. The study findings supported the hypothesis that the

combination of threat and coping appraisal beliefs explain which breast cancer survivors report higher fear of recurrence. However, the observed results did not support the hypothesized interaction between threat and coping appraisal for predicting either diet or exercise habits. Instead, coping appraisal alone predicted both fruit and vegetable consumption and exercise habits. Future research should focus on examining these relationships longitudinally and further assess coping appraisal and how it impacts fear of recurrence.

Introduction

As the medical treatment of cancer advances and survival rates improve, the number of cancer survivors continues to grow. This trend should motivate clinicians and researchers to take a closer look at the long-term consequences of diagnosis and treatment in order to be able to handle the increasing demands for post-treatment services. A commonly reported concern of cancer survivors is fear of recurrence, the lingering thoughts and concerns that despite successful treatment, the cancer may return as unexpectedly as it had at the original diagnosis. Elucidating the underlying factors that come together to shape these fears would help guide interventions designed to reduce these fears. Typically, risk-reducing health behaviors are expected to reduce the risk of recurrence, which in turn may help to reduce survivor's recurrence fears. The purpose of the present study is to examine the relationship of Protection Motivation Theory's threat and coping appraisal variables to both fear of recurrence and engagement in health behaviors. The goal is to establish how well these variables explain which survivors are more likely to report both fear of recurrence and adhere to recommended health behaviors.

Fear of Recurrence in Cancer Survivors: Conceptualization and Measurement

While cancer survivors can readily point out fear of recurrence as a prominent concern following completion of active treatment, researchers have had a harder time pin-pointing what fear of recurrence consists of as a measurable construct. The concept

can be as broad as over-arching cancer-related concerns or fears, involving both current difficulties and worries about the future and changes in prognosis, or as narrow as the specific fear of being diagnosed with the same type of cancer at the same site at some point in the future. More commonly, though, fear of recurrence concerns fears related to being diagnosed with the same type of cancer again at any point after initial diagnosis and treatment.

Although the number of studies focusing on fear of recurrence has increased over the years, there is no preferred method for measuring the construct. Some studies have relied on study-specific single-item measures that ask cancer survivors how concerned they are that the cancer may recur. An example of this type of single-item measure would be a question that asks participants to rate, on a 5-point scale from *poor* to *excellent*, how well they are doing with "worries about recurrence of cancer" (Lash, Clough-Gorr & Silliman, 2005). Some studies have taken fear of recurrence items from larger measures such as the Cancer Problems In Living Scale (CPILS) and analyzed them separately (Baker, Denniston, Smith, & West, 2005). Two CPILS items that relate to fear of recurrence are, "feeling fearful that my illness will return" and "concern about relapsing" with participants responding whether it is a severe problem, somewhat a problem, or not a problem (Baker et al., 2005). Similarly, the Questionnaire on Stress in Cancer Patients revised version (QSC-R23) has a single item that may capture fear of recurrence (Herschbach et al., 2004). Participants respond whether "being afraid of disease progression" applies to them, which gives an estimate of prevalence, and the extent to which this fear causes distress (Herschbach et al., 2004). These types of single-item measures avoid combining fears of recurrence with other more general worries

about health. They are limited, however, in that they do not collect enough information to help determine when fears reach clinically significant levels.

Another measurement strategy is to use multi-item scales such as the commonly used Fear of Recurrence Scale (Northouse, 1981). This scale is said to be unidimensional, but this claim is suspect due to inclusion of items ranging from concerns about current health, to triggers of worry, to recurrence fears, uncertainty, and worries about the health of others (Lee-Jones, Humphris, Dixon, & Hatcher, 1997). In light of these difficulties, several scales elect instead to purposely divide cancer-related worries into more than one dimension. One such measure is the six-item Assessment of Survivor Concerns (Gotay & Pagano, 2007). It contains two factors: one measuring fear of recurrence and another measuring general future health fears that may or may not be linked to cancer, like worrying about death or personal health (Gotay & Pagano, 2007). Another multidimensional scale is the Concerns About Recurrence Scale (CARS; Vickburg, 2003), designed for women with breast cancer. This scale is made up of five factors that cover a wide range of concerns that could be tied to fear of recurrence: overall fear, health worries, womanhood worries, role worries, and death worries (Vickberg, 2003). Multidimensional scales provide far more information about fear of recurrence, but also risk including items that relate to concerns that are not specific to recurrence such as general health concerns and concerns related to how one's social functioning may change should one become sick.

Finally, Rabin, Leventhal and Goodin (2004) devised a measure that modified Lerman's four-item Cancer Worry Scale (1991) to capture worry about getting diagnosed with cancer *again*. Rather than focusing on the consequences and meaningfulness of the

fear of recurrence like other multi-item scales, this scale focuses on how often these concerns occur and affect the mood and daily functioning of cancer survivors (Rabin et al., 2004). This type of scale has the benefit of providing more clinically meaningful information about the prevalence and extent of fears while still focusing exclusively on fears related to recurrence and not general health or other consequences of a cancer diagnosis. Unfortunately, this scale has rarely been used to date in research on fear of recurrence (McGinty, Andrykowski, & Jacobsen, 2008; Rabin et al., 2004).

Characteristics of Fear of Recurrence

Fear of recurrence is a common concern among all types of cancer patients. Data from the Survivors of Cancer Study-I (SCS-I) reported that the overwhelming majority of patients were experiencing concerns related to their cancer (Baker et al., 2005). Survivors surveyed one year after diagnosis expressed concerns about their illness returning (68.1% of those reporting), having a recurrence (59.8%), and fears for the future (57.7%) (Baker et al., 2005). In a study of women with breast cancer who had completed treatment and were transitioning into the so-called "re-entry" phase, 39% rated fear of recurrence as a dominant concern and nearly half felt that they had moderate-to-high unmet needs about addressing these fears (Stanton et al., 2005). Even long-term survivors continue to have fears about their health. In one study, roughly one third of breast cancer survivors averaging ten years since diagnosis reported worries about a future recurrence, concerns that their current physical symptoms may signal a recurrence, concerns about developing another type of cancer, or worry about future diagnostic tests (Deimling, Bowman, Sterns, Wagner & Kahana, 2006). A study of breast cancer patients using the modified Cancer Worry Scale only reported the average item score for breast

cancer patients three weeks before, one month after, and three months after cessation of treatment (Rabin et al., 2004). The average item score for the sample fell between *not at all or rarely* and *sometimes* for the previous month across the three assessments (Rabin et al., 2004). In another study using the modified Cancer Worry Scale, 18% of breast cancer survivors surveyed three years following treatment reported worrying about recurrence *often* or *a lot* in the past month (McGinty et al., 2008).

Predictors of Fear of Recurrence

Several factors have been found to be related to differences in fear of recurrence among people diagnosed with cancer. With regard to demographic variables, older age and being African American have been found to be related to less reported fear of recurrence (Deimling et al., 2006; Stanton et al., 2006; van den Beuken-van Everdingen et al., 2008). With regard to clinical variables, less time since diagnosis, past mastectomy, past chemotherapy, more symptoms since diagnosis, more current symptoms, and pain were found to be related to more fear of recurrence using various measures (Rabin et al., 2004; Deimling et al., 2006; Stanton et al., 2006; van den Beuken-van Everdingen, et al., 2008). Various psychosocial variables also appear to play a role in recurrence fears. Positive relationships have been reported between fear of recurrence and general levels of anxiety and depression (Deimling et al., 2006). Patients who used avoidance-oriented coping styles or who were less optimistic have also been found to report more fear of recurrence (Deimling et al., 2006; Stanton, Danoff-burg, & Huggins, 2002; Stanton et al., 2006). In addition, conceptualizing cancer as being an acute illness, rather than either a chronic or cyclic condition is related to less fear of recurrence (Rabin et al., 2004). The influence of family caregivers may also shape fears of recurrence, as

the fears of the survivor are related to those of the caregiver and vice versa (Mellon, Kershaw, Northouse, & Freeman-Gibb, 2007). More family stressors, finding less positive meaning in the cancer experience, and younger caregivers paired with older survivors are additional factors related to greater fear of recurrence in survivors and caregivers alike (Mellon et al., 2007).

As noted above, the existing literature has identified several demographic, clinical, and psychosocial variables that are related to fear of recurrence and may assist in identifying which patients are at higher risk for developing these fears. However, there are also several limitations with this body of research. Due to the various types of measures employed to study recurrence fears, it is difficult to generalize findings from one study to the next. Each measure seems to identify different aspects of recurrence fears, from direct measures of how much one is distressed by the fear to the myriad fears that accompany any diagnosis of a severe medical problem. In addition, the study samples differ widely in terms of their disease characteristics, objective risk of recurrence, and time since treatment completion. Also, it is rare for a study examining correlates of fear of recurrence to be informed by a conceptual model. Before describing a conceptual model of considerable relevance to the study of fear of recurrence (i.e., Protection Motivation Theory), this proposal will first consider the issue of how fear of recurrence may have an influence on the health behaviors of cancer survivors.

Health Behaviors in Cancer Survivors: American Cancer Society Recommendations

A major aim of the current study is to identify variables related to engagement in health behaviors that could potentially reduce the risk of recurrence among cancer survivors. To address this issue, it is important to identify health behaviors that have

been recommended for cancer survivors and their potential to reduce the risk of new malignancies. The American Cancer Society (ACS) provides recommendations for cancer survivors based primarily on their recommendations for cancer prevention in healthy populations (Doyle et al., 2006). Reflecting evidence that many primary and secondary cancers are linked to being overweight, especially in the case of breast cancer, the guidelines focus on factors that would help maintain a healthy weight, such as diet and exercise recommendations (Doyle et al., 2006). Specifically, survivors are encouraged to 'adopt a physically active lifestyle' defined as at least 30 minutes of moderate to vigorous activity (not including usual activities) five or more days each week, with 45-60 minute sessions preferable (Doyle et al., 2006). Diet is also at the heart of the ACS recommendations, with the focus on a plant-based diet. Survivors should strive to eat five or more servings of fruits and vegetables per day, substitute whole grains for refined or processed grains, and reduce processed and red meats in the diet (Doyle et al., 2006).

Few studies to date have demonstrated a connection between physical activity (PA) and cancer survival, but associations have been shown between physical activity and quality of life (Blanchard, Courneya, & Stein, 2008; Courneya, 2003; Knols, Aaronson, Uebelhart, Fransen, & Aufdemkampe, 2005;), reduced treatment-related symptoms such as fatigue (Rabin, Pinto, Dunsiger, Nash, & Trask, 2008; Schmitz et al., 2005), and reduced risk of other life-threatening comorbidities (i.e., diabetes and cardiovascular disease) (Doyle et al., 2006). At least one study has found that survival improves with moderate weekly PA levels. Breast cancer patients who reported the equivalent of 3-5 hours of walking each week had better survival rates than those who

were more sedentary; interestingly, more exercise each week over and above moderate levels did not provide increasing benefits for survival (Holmes, Chen, Feskanich, Kroenke, & Colditz, 2005). The connection between obesity and survival (Bianchini, Kaaks, & Vainio, 2002; Kroenke, Chen, Rosner, & Holmes, 2005; Norman et al., 2007) and evidence that breast cancer survivors may be at risk for weight gain following diagnosis and treatment (Rock et al., 1999) makes PA recommendations logical contributors to overall health recommendations for cancer survivors.

Similarly, the diet recommendations are based on broad health improvement rather than data that confirm direct survival benefits (Doyle et al., 2006). At one point, reducing fat intake was assumed to be the most important factor in increasing survival after a cancer diagnosis, but there has not been sufficient evidence to support this claim (Greenwald, Sherwood, & McDonald, 1997). Recent research is turning away from dietary fat and towards evidence for the benefits of fruit and vegetables (Willett, 2005). Some reviews cite evidence across several studies that fruit and vegetable consumption is associated with better survival rates in breast cancer survivors (Ewertz, Gillanders, Meyer, & Zedeler, 1991; Holmes et al., 1999; Ingram, 1994; Jain, Miller, & To, 1994; Rohan, Hiller, & McMichael, 1993).

Measuring Health Behavior Change

Research on health behaviors in cancer patients has tended to use one of three designs: comparing survivors to healthy control subjects, comparing survivors to themselves over time, and a combination of the two (i.e., following both survivors and controls over time). Behavioral data are analyzed as either rates of activity over a particular time period or are used to classify participants as complying with certain

guidelines or study-specific criteria for eating healthy or being physically active. Self-reported changes often serve as a proxy for collecting behavioral data prior to diagnosis, with cancer survivors being asked to indicate any changes they have made since being diagnosed and the direction of change. Studies of PA and diet behaviors in cancer survivors have typically relied on self-report measures. Reports of frequency and duration of bouts of different types of exercise provide information about regular exercise habits. Most studies define what is considered "exercising", often providing examples of what does and does not count as exercise. Diet is often measured through the use of food frequency questionnaires (FFQ) where participants are asked to recall specific amounts of particular foods over a specified time period, typically the past week or past month. This allows researchers to focus on the patterns of consumption for particular foods and helps identify which food types are predominant in a person's diet, rather than simply asking if people do or do not meet certain quantities of particular nutrients.

Prevalence of Health Behavior Changes

Changes in health behaviors appear to be common among cancer survivors, keeping in line with Taylor's (1983) findings that approximately two-thirds of survivors interviewed saw themselves as having some personal control over their chances of a cancer recurrence. However, a study of global health changes since diagnosis in cancer survivors across the major types of cancer found that fewer patients than might be expected made specific changes based on advice from their doctors (Blanchard, Denniston, et al., 2003). For example, only 46% of smokers had quit smoking following diagnosis, while 47% of the total sample improved their diet (including 50.6% of respondents reducing fat, 43.5% increasing fiber, and 42.9% reducing red meat) with

influence from their doctor (Blanchard, Denniston, et al., 2003). Another study found that 48% of cancer patients reported making positive changes in their diet following diagnosis consistent with health guidelines (Maskarinec, Murphy, Shumay, & Kakai, 2001). Forty-one percent of breast cancer patients in another study reported making some type of diet change in the year following diagnosis; decreasing red meat (77% of those who reported diet change) and increasing fruits and vegetables (72%) were the most common changes (Maunsell, Drolet, Brisson, Robert, & Deschenes, 2002). Participants in the Women's Healthy Eating and Living (WHEL) study reported several changes in diet following breast cancer diagnosis, including eating more fruits (57.9%), vegetables (60.4%), and fiber-rich foods (38.8%) (Thomson et al., 2002).

Turning to physical activity levels, one study found that relatively few cancer patients had started exercising more since their diagnosis (15.7%), while nearly twice as many (30.6%) were exercising less than they had before getting cancer (Blanchard, Denniston, et al., 2003). However, in another study 58% of a sample of patients with early stage breast or prostate cancer reported participating in routine exercise on a regular basis for an average of 40 minutes, 4 times a week (Denmark-Wahnefried, Peterson, McBride, Lipkus, & Clipp, 2000).

Several studies have compared the physical activity patterns of cancer patients with healthy controls. Baseline data from the Life after Cancer Epidemiology (LACE) study found PA patterns to be similar between breast cancer patients two years after diagnosis and healthy comparison samples from other studies (Caan et al., 2005). However, another study using a nationally representative sample found that physical inactivity was more common in cancer patients than healthy controls, with nearly three-

fourths of cancer patients considered physically inactive; there were no measured dietary differences between groups (Coups & Ostroff, 2005). Similarly, data from the Health Information National Trends Study (HINTS) revealed only 45.3% of cancer patients reported being active at least weekly compared to 53% of non-patients (Mayer et al., 2007). Perhaps most concerning, there was a low reporting of beliefs that health behaviors could reduce the risk of cancer (Mayer et al., 2007). A potential reason for the conflicting evidence on PA following diagnosis is the finding that PA levels decrease in the year following diagnosis compared with levels one year prior, with an average decrease being two hours less activity per week (Irwin et al., 2003). Pinto, Trunzo, Reiss, and Shiu (2002) also followed women in their first year after diagnosis and found exercise levels did not increase on average.

Other research has examined whether cancer survivors are meeting recommendations for healthy behaviors set by various organizations. For physical activity, Bellizzi, Rowland, Jeffrey and McNeel (2005) found that survivors were 9% more likely to be meeting PA recommendations compared to healthy controls in a nationally representative sample, with survivors 2-9 years post diagnosis the most likely to meet recommendations. Unfortunately, fully three-fourths of survivors were not meeting PA recommendations (Bellizzi et al., 2005). Another study comparing healthy women to breast cancer survivors following treatment found survivors were more likely to meet recommended PA levels after controlling for demographic variables than controls, with both frequency and duration of exercise being higher in survivors for activities like stretching (Blanchard, Cokkinides, et al., 2003). Data from the Cancer Survivors Study-II (SCS-II) confirmed that only 29.6-47.3% of all cancer survivors

(representing a variety of cancer types) were meeting PA recommendations (Blanchard et al., 2008). Breast cancer patients reported adhering to PA recommendations 37.1% of the time (Blanchard et al., 2008).

In terms of adherence to dietary recommendations, Caan et al. (2005) found early stage breast cancer survivors two years after diagnosis reported a mean of fewer than four servings of fruits and vegetables a day, just missing the five a day recommendation. In another study, 55% of survivors of breast or prostate cancer were meeting the five a day guideline and 69% reported adhering to a low-fat diet (Denmark-Wahnefried et al., 2000). Reports from the HINTS and SCS-II data were less positive, with 18% and 14.8-19.1% of survivors meeting recommendations respectively (Mayer et al., 2007; Blanchard et al., 2008). Comparisons by cancer type revealed melanoma and prostate cancer patients were the most likely to meet fruit and vegetable recommendations out of the most common cancer types (Coups & Ostroff, 2005).

Predictors of Health Behavior Changes

Receiving a cancer diagnosis alone may not predict behavior change, so it is important to determine what other factors predict health behavior change in cancer patients. In a qualitative research study, Maskarinec et al. (2001) found themes for diet change following diagnosis of cancer that ranged from desire to improve overall physical well-being through better nutrition, maintaining health, preventing recurrence, and beliefs that foods that determine cancer risk should be changed to reduce risk. A study of breast cancer patients assessed during the first year after treatment completion found that the following were related to greater changes in dietary behavior: younger age, hormone positive status, history of adjuvant treatment, and higher levels of distress (Maunsell et

al., 2002). On average, less than 9% of those who made changes made negative dietary changes (Maunsell et al., 2002). The relationship of distress to diet change was particularly strong. Women who changed their diets had the greatest reductions in distress after one year compared to women who did not change their diets (in either a positive or negative direction) (Maunsell et al., 2002). A study of women during the first three years after breast cancer diagnosis found that those treated with radiation plus chemotherapy experienced greater declines in PA compared those women treated with surgery only or radiation only (Irwin et al., 2003); additional findings showed that obese patients decreased PA immediately after diagnosis to a greater extent than normal weight patients (Irwin et al., 2003). Another study of women with breast cancer found that younger age, having a significant other, a longer time since diagnosis, higher social support, and higher initial depression predicted greater increases in PA over a 12-month period following treatment completion (Pinto et al., 2002).

Few studies to date have examined the relationship between fear of recurrence and protective health behaviors. Previous work in this area has focused on the conceptualizations of cancer that serve as the source of motivating fears, often relying on Leventhal's Self Regulation Model (Costanzo, Lutgendorf, Bradley, Rose, & Anderson, 2005; Lee-Jones et al., 1997; Rabin & Pinto, 2006). This model elaborately details the formation of illness representations based on several features of the target illness that include illness symptoms, timeline, consequences, causes, and controllability (Leventhal, Diefenbach, & Leventhal, 1992). Using this model, Rabin and Pinto (2006) found that women with breast cancer who attributed cancer to diet were more likely to report changing their diet and alcohol consumption than those who did not think diet caused

their cancer (Rabin & Pinto, 2006). Also, beliefs that healthy behaviors such as diet, exercise, and reduced alcohol consumption could control cancer risk were found to predict subsequent changes in diet and alcohol consumption (Rabin & Pinto, 2006).

Overview of the Protection Motivation Theory Model

As noted previously, a major limitation of previous research examining predictors of fear of recurrence and health behaviors in cancer survivors is the general lack of use of conceptual models to select variables and formulate hypotheses. In this section, we seek to show the relevance of Protection Motivation Theory (PMT) to the study of these issues. Protection Motivation Theory (see Figure 1), first proposed by Rogers (1975), states that there are two processes that determine intentions to adopt protective health behaviors (Maddux & Rogers, 1983; Ripptoe & Rogers, 1987; Rogers, 1975). The first component is related to the individual's evaluation of the possible health threat, referred to as *threat appraisal* (Rogers, 1975). Threat appraisal is comprised of *vulnerability*, the perceived personal risk that the health threat will occur, and *severity*, the inherent dangerousness of the health threat if it were to happen (Ripptoe & Rogers, 1987). Together, vulnerability and severity *increase* both the level of fear arousal and the likelihood of performing protective health behaviors (Ripptoe & Rogers, 1987). The second component, called *coping appraisal*, is made up of the individual's assessment of their ability to reduce or even eliminate the threat (Maddux & Rogers, 1983; Rogers, 1975). Coping appraisal is made up of *response efficacy*, the expectation that a given behavior will successfully reduce the health threat and *self-efficacy*, the belief that one can successfully perform a given behavior (Ripptoe & Rogers, 1987). Response efficacy and self-efficacy combine to improve the motivation to adopt certain behaviors (Ripptoe

& Rogers, 1987). Threat and coping appraisal combine to form *protection-motivation*, the intention to adopt a particular set of protective health behaviors, which serves as the theoretical mediator between cognitions and health protective behaviors (Maddux & Rogers, 1983; Rogers, 1975).

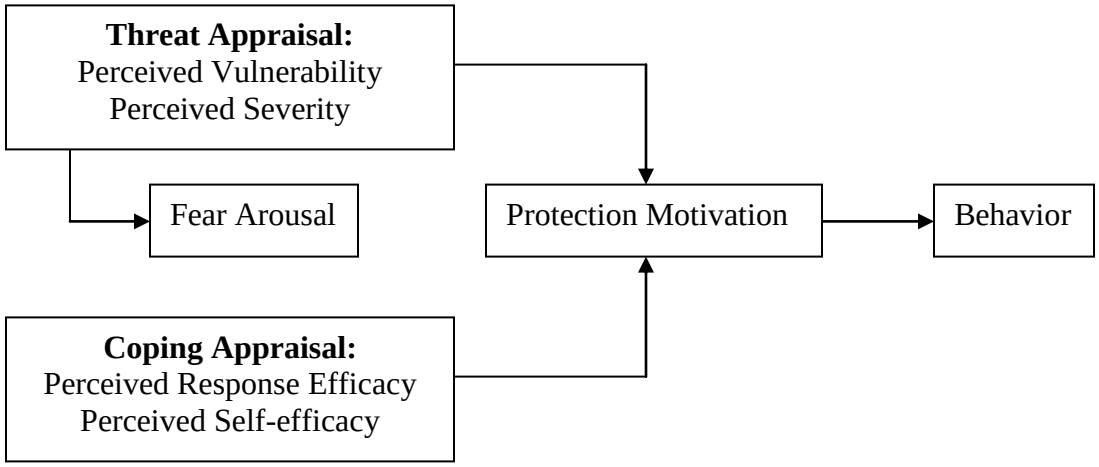

Figure 1. Protection Motivation Theory Model.

PMT has an advantage over other health theories in that it identifies predictors of both fears and behaviors; other health belief theories focus more strictly on prediction of health behaviors (Helmes, 2002; Ripptoe & Rogers, 1987). While models such as the Cognitive-Social Health Information Processing (C-SHIP) model also factor in fear and anxiety in the prediction of health behaviors from perceived threats, PMT is more parsimonious, relying on a handful of predictive variables in contrast to the myriad of predictors in C-SHIP models (Miller, Shoda, & Hurley, 1996). Protection Motivation also explores the influence of self-efficacy, which has repeatedly been shown to be a strong predictor of adoption of new behaviors (Floyd, Prentice-Dunn, & Rogers, 2000; Maddux & Rogers, 1983; Milne, Sheeran, & Orbell, 2000; Schwarzer, 2008; Seydel, Taal, & Wiegman, 1990; Sheeshka, Woolcott, & MacKinnon, 1993; Stanley & Maddux,

1986). However, there have been criticisms of the PMT framework (McCaul & Mullens, 2003; Salovey, Rothman, & Rodin, 1998; Witte, 1992; Witte, 1998). The effects of threat and coping appraisal on behaviors is predicted to be summative in the original model, however, interactions between at least one threat appraisal variable and at least one coping appraisal variable predicting intentions to perform behaviors are commonly found in research using PMT (Maddux & Rogers, 1983; Wurtele & Maddux, 1987; Witte, 1998). Also, the original model suggests that fear is only predicted by threat appraisal and that coping appraisal does not influence fear at all; recent findings contradict this view (McMahan, Witte, & Meyer, 1998; Witte, 1992; Witte, 1998). McMahan et al. (1998) found that coping appraisal variables such as self-efficacy predicted so-called fear control responses in participants presented with messages about protecting themselves from a possible environmental health threat. These findings demonstrate that fear responses such as defensive avoidance or minimization of the threat are influenced by perceived ability to control and reduce the threat; threat appraisal alone does not predict fear control responses (McMahan et al., 1998). Reflecting these findings, the Extended Parallel Process Model uses the same variables as PMT, but hypothesizes that interactions between threat and coping appraisal determine the level of fear and the likelihood of performing the target health behavior (Witte, 1992; Witte, 1998).

Overview of the Current Study

As noted previously the purpose of the present study is to examine the relationship of PMT's threat and coping appraisal variables to both fear of recurrence and engagement in health behaviors. Toward this end, this study will administer

questionnaires to women who have completed treatment for breast cancer between six and twenty-four months previously and currently have no clinical evidence of disease. In the following section, hypotheses are presented based on PMT regarding fear of recurrence and engagement in health behaviors.

Relationship of Coping and Threat Appraisal to Fear of Recurrence

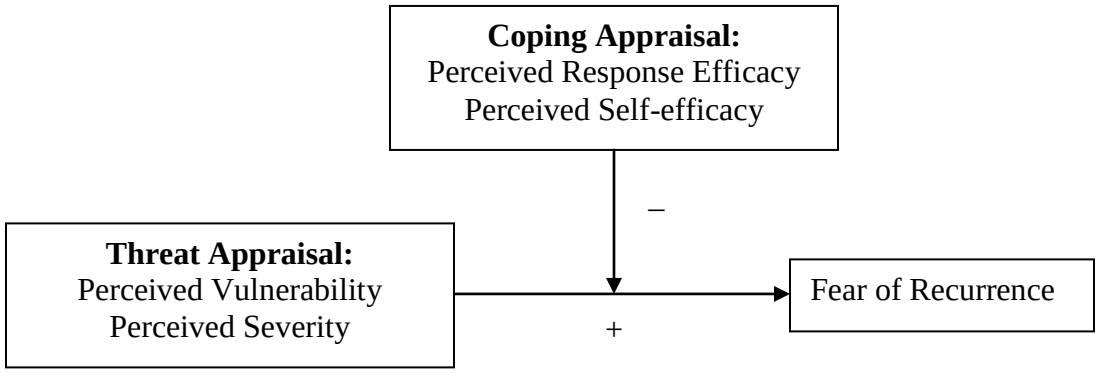

Figure 2. Relationship between PMT variables and fear of recurrence.

Hypothesis 1: It is hypothesized that the interaction between threat appraisal and coping appraisal will be related to fear of recurrence (see Figure 2). Specifically, it is hypothesized that survivors who report high levels of threat appraisal in combination with low levels of coping appraisal will report greater fear of recurrence than survivors who report low levels of both threat and coping appraisal, low levels of threat appraisal but high levels of coping appraisal, or high levels of threat appraisal and high levels of coping appraisal (see Figure 3). Reporting high threat appraisal, but low coping appraisal means that one anticipates a health threat, but perceives there to be few protective efforts available to reduce the risk. These predictions are consistent with the Expanded Parallel Process Model which builds upon the PMT framework and which proposes that high threat appraisal in combination with low coping appraisal lead to fear responses (McCaul & Mullens, 2003; Witte, 1992; Witte, 1998).

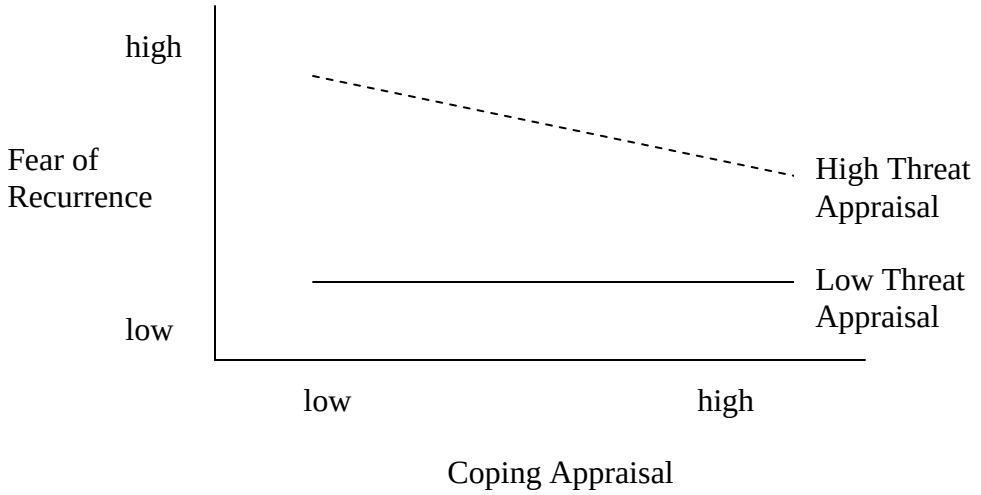

Figure 3. Hypothesized relationship between PMT variables and fear of recurrence.

Existing research provides some support for this hypothesis. A study by Helmes (2002), examining the relationship of PMT variables to prediction of genetic testing in high risk women, found that vulnerability beliefs were related to fears and worries about getting cancer and intrusive thoughts about cancer. Women who were high in vulnerability reported more cancer worry and more intrusive thoughts about cancer (Helmes, 2002). The impact of severity perceptions on fear has also been demonstrated; with high severity perceptions being related to more fear than low severity (Maddux & Rogers, 1983). In a study directly relevant to the current one, Ripptoe and Rogers (1987) found that healthy women who were told that breast self-examination was both an easy (high self-efficacy) and effective (high response efficacy) method of reducing the threat of breast cancer reported the lowest levels of fear (Ripptoe & Rogers, 1987).

Relationship of Coping and Threat Appraisal to Health Behaviors

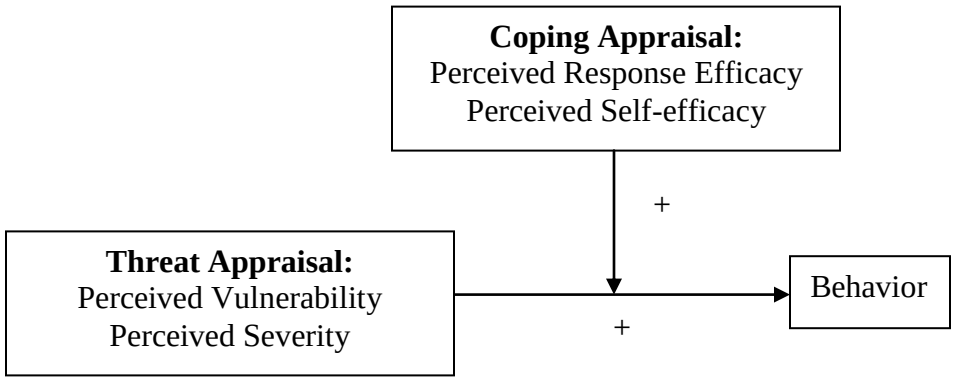

Figure 4. Relationship between PMT variables and recommended health behaviors.

Hypothesis 2: It is hypothesized that the interaction between threat appraisal and coping appraisal will be related to engagement in health-related behaviors (see Figure 4). Specifically, it is hypothesized that survivors who report high levels of both threat appraisal and coping appraisal will report greater engagement in behaviors than survivors who report low levels of both threat and coping appraisal, low levels of threat appraisal but high levels of coping appraisal, or high levels of threat appraisal but low levels of coping appraisal (see Figure 5). Those who anticipate a threat and feel confident in their ability to perform behaviors they believe will reduce the possibility of the threat will be motivated the most to act accordingly. Those who are low in threat appraisal will be less motivated to alter their current behaviors since they do not expect that there will be any related health consequences for failing to act. Also, those who are high in threat appraisal, but low in coping appraisal will be less motivated to change their behaviors to protect against a perceived health threat since they will not feel capable of performing any actions that might reduce the threat.

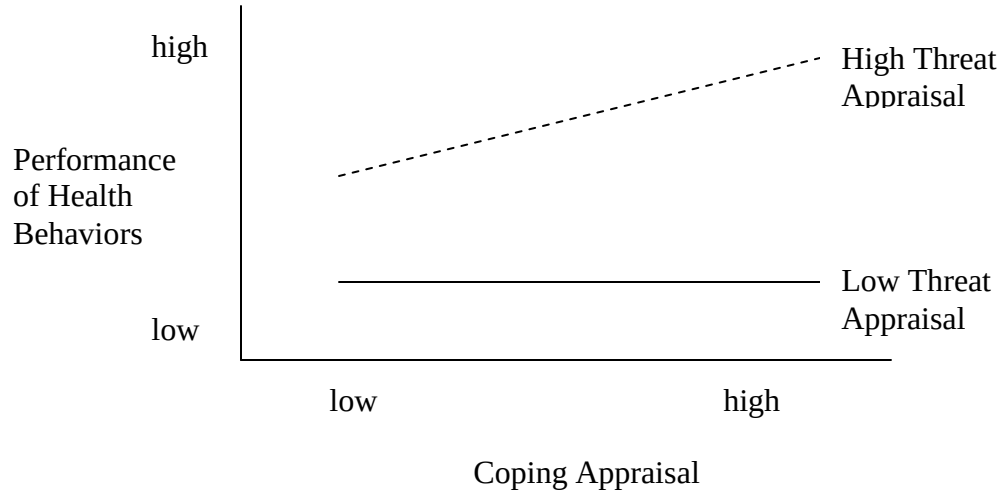

Figure 5. Hypothesized relationship between PMT variables and health behaviors.

The influence of PMT variables on health behavior intentions and ultimately, performance of protective health measures has been widely documented. Reviews of the literature have found that all four PMT variables positively relate to both current behaviors and intentions to perform protective behaviors, with severity having the smallest influence on intentions (Milne et al., 2000). A review by Floyd et al. (2000) found that vulnerability and self-efficacy produced the strongest effects in cancer prevention behaviors such as sunscreen use and breast self-exams. In general, threat appraisal variables had stronger relations to subsequent behaviors than coping appraisal variables, but both were still important predictors of behaviors (Floyd et al., 2000). Studies with healthy participants have also found both vulnerability and self-efficacy beliefs to be related to intentions to exercise (Wurtele & Maddux, 1987). In addition, self-efficacy and fear of coronary heart disease were related to intentions to increase exercise in recovering cardiac patients (Plotnikoff & Higginbotham, 1998). There are also studies demonstrating the effectiveness of the PMT-based interventions to promote health behaviors. By increasing both threat and coping appraisal McClendon and

Prentice-Dunn (2001) were able to reduce participants' intentions to tan, thus reducing skin cancer risk in a sample of college students who had a history of purposely tanning. Beyond simply reducing risky behaviors by influencing threat and coping appraisals, other studies were able to increase intentions to perform novel health behaviors. Courneya and Hellsten (2001) manipulated PMT variables and measured college students' intentions to start following exercise recommendations to prevent colon cancer. Again, both threat and coping appraisal were positively related to intentions to perform the recommended exercise regimen (Courneya & Hellsten, 2001).

Exploratory Analyses

Finally, exploratory analyses will be performed to determine the interrelationships among threat and coping appraisal, health behaviors, and fear of recurrence (see Figure 6). In particular, three possible ways that these variables could be related will be examined. The first two ways assume that a relationship will be observed between fears of recurrence and health behaviors. Prior research suggests that an inverse relationship between health behaviors and fear of recurrence in cancer survivors will be observed. Along these lines, Maunsell et al. (2002) found that women with breast cancer initially high in distress were more likely to change their diet for the better during the first 12 months after surgery than women low in distress. Assuming that a relationship between health behaviors and fear of recurrence is observed and that coping and appraisal variables are related to both fear of recurrence and health behaviors, the proposed analyses will examine whether health behaviors mediate the relationship between coping and appraisal variables and fear of recurrence (Figure 6-A) or whether fear of recurrence

mediates the relationship between coping and appraisal variables and health behaviors (Figure 6-B) or whether there is no mediation.

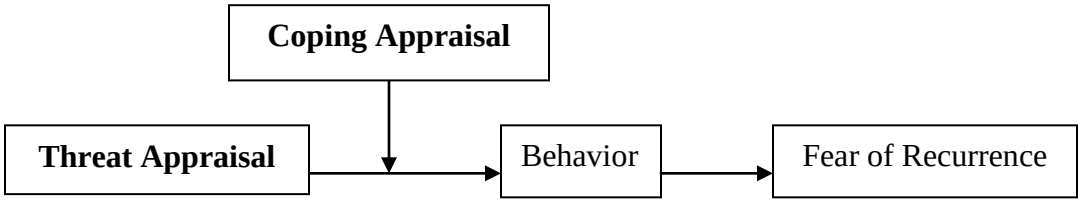

Figure 6-A. Behavior mediates relationship between PMT and fear of recurrence.

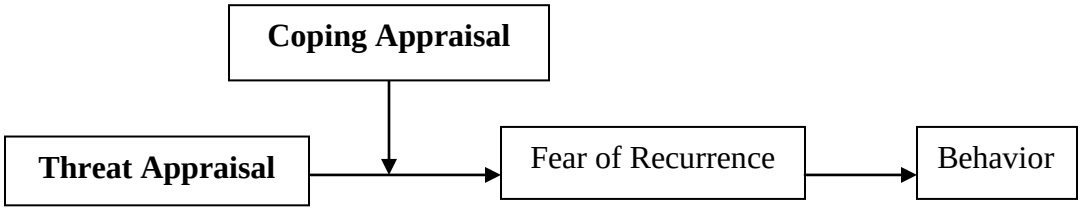

Figure 6-B. Fear of recurrence mediates relationship between PMT and behavior.

Method

Participants

The sample was comprised of women who had been treated for early stage breast cancer (stage I-II) six to twenty-four months prior to enrollment in the study. Additional eligibility criteria were: a) ability to give informed consent, b) ability to speak and read English, c) no history of other cancers except non-melanoma skin cancer, d) no recurrence of breast cancer since original diagnosis and, e) age between 18 and 90.

Measures

Demographic characteristics. A standardized self-report form was used to collect the following demographic information: age, height, weight, race, ethnicity, marital status, and highest degree attained.

Clinical characteristics. Clinical characteristics collected via chart review included stage at diagnosis, treatment(s) received (including any surgeries or adjuvant treatments), and time since diagnosis and treatment completion.

Fear of recurrence. The four-item Cancer Worry Scale (Lerman et al., 1991) was adapted to apply to cancer patients' concerns of a possible recurrence by adding the phrase 'cancer again' to each item to create a modified Cancer Worry Scale (mCWS) (Rabin et al., 2004). This measure assesses the frequency of recurrence worry over the course of the past month. Response options for each item were 1 (*Not at all or rarely*), 2 (*Sometimes*), 3 (*Often*), or 4 (*A lot*). The revised version has demonstrated acceptable

internal consistency in a sample of breast cancer survivors (Cronbach's α = .78) and is positively related to measures of psychological distress such as the CES-D (r = 0.49) and negatively related to mental health (r = -0.43) (McGinty, et al., 2008). This measure had good internal consistency in the current sample (Cronbach's α = .87).

Vulnerability. Perceived vulnerability to a cancer recurrence was measured by participants' estimates of their absolute and comparative risk using items adapted from prior research (Valdimarsdottir et al., 1995). To assess absolute risk participants were asked, "How likely do you think you are to have breast cancer again during your lifetime?" and to assess comparative risk they were asked, "What do you think your chances are of having breast cancer again in your lifetime compared to other women your age with breast cancer who received the same treatment for the same type of breast cancer?". Responses options ranged from *extremely unlikely* to *extremely likely* on a 6-point scale for the absolute risk item and from *much higher* to *much lower* on a 5-point scale for the comparative risk item. Absolute and comparative risk estimates were converted to the same metric and then combined to create a total vulnerability score (Cronbach's α = .75).

Severity. The Consequences Subscale of the Revised Illness Perception Questionnaire (Moss-Morris et al., 2002) was used to determine perceived severity of the consequences of a potential breast cancer recurrence. All items were adapted to refer to a "recurrence of breast cancer" as the target illness to be considered. Items reflect the potential medical, social, financial, and psychological consequences of a breast cancer recurrence. Participants were asked to respond how much they agreed with each consequence on a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly*

agree). This measure showed acceptable validity and good internal consistency for the selected subscale (Cronbach's α = .84) in previous research (Moss-Morris et al., 2002). Internal consistency was also good for the current study sample (Cronbach's α = .81).

Self-efficacy. Participants indicated the extent to which they felt capable of successfully adhering to both diet and exercise recommendations from the American Cancer Society (ACS) (Kushi et al., 2006) to provide information about self-efficacy beliefs regarding these health behaviors. With regard to diet, the ACS recommends eating five or more servings of fruits and vegetables a day, whole grains in place of refined grains, and limiting consumption of red meats. With regard to exercise, the ACS recommends at least 30 minutes of moderate to vigorous physical activity over and above usual activities at least 5 days a week. After reading these recommendations, participants were asked to rate their degree of confidence that they could adhere to the recommendations given 18 different hypothetical circumstances that may limit regular activity using a scale from 0 (*cannot do at all*) to 10 (*highly certain can do*) (Bandura, 2006). Similarly, participants also responded to 30 items detailing circumstances that may limit adherence to ACS diet recommendations (Bandura, 2006). The approach described here, which is modified after that recommended by Bandura (2006), was found to yield acceptable psychometric properties for the exercise measure in a Korean sample of patients with chronic illness (Shin, Jang, & Pender, 2001). In that study, the scale overall had excellent internal consistency with Cronbach's α = .94. Test-retest reliability was evaluated after a two week period, resulting in a strong correlation between testing intervals (r = 0.77) (Shin et al., 2001). For the current study sample, internal consistency

was excellent for both the exercise self-efficacy measure (Cronbach's $\alpha = .97$) and the diet self-efficacy measure (Cronbach's $\alpha = .97$).

Response efficacy. Participants were also asked about their perceptions of the response efficacy of the ACS diet and exercise recommendations using a format adapted from previous research (Plotnikoff & Higgenbotham, 1995; 1998 cited in Rhodes & Plotnikoff, 2005). Similar items were used to assess efficacy of diet and exercise recommendations separately as follows, "To what extent do you agree or disagree with the following sentence: Following the American Cancer Society's guideline for a *physically active lifestyle* would reduce your chances of having a breast cancer recurrence" for exercise recommendations and "To what extent do you agree or disagree with the following sentence: Following the American Cancer Society's guideline for a *healthy diet* would reduce my chances of having a breast cancer recurrence" for diet recommendations. Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*).

Dietary behavior. To assess adherence to a diet rich in fruits and vegetables, participants first completed the All-Day Screener, which details number of servings and serving sizes for a variety of fruits and vegetables consumed on a regular basis for the past month (Thompson et al., 2002). Participants' responses were also used to categorize them as adherent or nonadherent to ACS recommendations that survivors consume five or more servings of fruits and vegetables every day.

Exercise behavior. The Leisure Score Index (LSI) was used to record the amount of exercise participants reported for the previous week above usual activities (Godin & Shephard, 1985). Exercise was divided into three categories based on intensity

of exercise: strenuous, moderate, and mild exercise. Both the frequency and duration of exercise for each class of physical activity was recorded. Weekly metabolic equivalents (METS) were calculated by the following formula: total METS = (total minutes of strenuous exercise X 9) + (total minutes of moderate exercise X 5) + (total minutes of mild exercise X 3) (Godin & Shepard, 1985). Participants' LSI responses were also used to categorize them as adherent or nonadherent to ACS recommendation that survivors engage in at least 30 minutes of moderate to vigorous activity at least five days a week (Kushi et al., 2006).

Depression. The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess depressive symptoms in this sample (Radloff, 1977). This 20-item measure assessed common depressive symptoms that are not attributable to common health-related problems typically found in medical patient populations, such as sleep disturbance and lack of energy. Sample items include, "I had crying spells," "I had trouble keeping my mind on what I was doing," "I felt lonely," and "I enjoyed life" (reverse scored). Response options ranged from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). Depressive symptomatology was examined as a potential confounding variable in the statistical analyses using this measure. The internal consistency for this sample for the CES-D was excellent (Cronbach's $\alpha = .91$).

Procedure

Following chart review for initial eligibility, potential participants were mailed a letter describing the study and a postcard to return if they wish to decline participation. Women were also mailed an informed consent form, additional eligibility screening measures (including questions regarding ability to read and write in English and

confirmation that they had not have a breast cancer recurrence or other cancer diagnosis), questionnaire packets, and postage paid return envelopes. Women who did not meet full eligibilty criteria were instructed to only complete the screening measure and consent form and return the rest of the packet blank. Participants who did not return completed forms via mail within the one month deadline were contacted via phone three times with reminders to complete and return the survey within the next month at which point non-responders were considered lost to follow-up.

Participants who met full screening criteria first provided basic demographic information and then responded to the modified Cancer Worry Scale to provide their baseline level of personal fear of recurrence. Next, threat appraisal was assessed by vulnerability and severity perceptions. Participants were then asked to give information on their current exercise and diet habits followed by a description of ACS recommended diet and exercise guidelines to assess adherence. Current health behaviors were assessed prior to outlining ACS recommendations to reduce demand characteristics for current habits. Women were then asked about their perceived response efficacy and perceived self-efficacy for ACS diet and exercise recommendations regardless of whether they have ever attempted these or not. Participants first responded to items about their current exercise and perceived response efficacy and self-efficacy of adhering to ACS exercise recommendations, and then completed the same measures for diet.

Statistical Analyses

Hypothesis 1 states that there will be an interaction between threat and coping appraisal such that those with high threat appraisal and low coping appraisal will report greater fear of recurrence than those with overall low threat appraisal or high coping

appraisal. To test this hypothesis, the data were analyzed using multiple regression analysis. The data for the independent variables were centered following procedures recommended by Aiken and West (1991). Composite threat appraisal and coping appraisal variables were first computed. To form the threat appraisal variable, scores for perceived vulnerability and severity were transformed to z-scores and then summed. For coping appraisal, three different composite variables were created: diet coping appraisal, exercise coping appraisal, and overall coping appraisal. Diet coping appraisal represents the sum of the z-scores for diet self-efficacy and diet response efficacy. Exercise coping appraisal represents the sum of the z-scores for exercise self-efficacy and exercise response efficacy. To compute the overall coping appraisal variable, z-scores for diet self-efficacy, exercise self-efficacy, diet response efficacy, and exercise response efficacy were combined. After entering the threat appraisal variable and the appraisal variable on the first step, the possible presence of an interaction was examined by entering the multiplicative product of these two variables on the second step. A significant change in variance accounted for (R^2) on the second step would support the study hypothesis. If a significant interaction was obtained, procedures outlined by Aiken and West (1991) were then conducted to determine whether the nature of the interactive effect conformed to expectations.

Hypothesis 2 states that there will be an interaction between coping and threat appraisal such that those who are both high in threat and high in coping will report more health-promoting behaviors than those who are either low in both or low in either threat or coping appraisal. Procedures similar to those described above for hypothesis 1 were used to test hypothesis 2. The threat appraisal variable was the same as that used to test

hypothesis 1. For coping appraisal, only the diet coping appraisal term was used to predict daily fruit and vegetable intake, and only the exercise coping appraisal term was used to predict weekly exercise. Diet and exercise outcomes were predicted as continuous variables (total average number of daily fruit and vegetable servings, total weekly METS) in hierarchical regressions. Separate analyses were conducted to evaluate dietary and exercise behavior. A similar set of analyses was conducted using multiple logistic regressions to examine interactive effects on adherence to ACS diet and exercise recommendations (a dichotomous variable).

Finally, a set of exploratory analyses were planned to examine relationships among threat and coping appraisal, health behaviors, and fear of recurrence. First, univariate analyses were conducted to determine whether fear of recurrence and performance of the two different health behaviors were related to each other. If there were a significant relationship between reported fear of recurrence and current performance of healthy behaviors, the mediational analyses would then be conducted. The first analysis would examine whether the combination of high coping appraisal and high threat appraisal is associated with greater engagement in health behaviors that, in turn, should be associated with lower fear of recurrence (Figure 6-A). To evaluate this possibility, a series of regression analyses and a Sobel test would be conducted to determine whether health behaviors mediate the expected relationships of threat and coping appraisal with fear of recurrence. The alternative possibility, that fear of recurrence mediates the relationship between PMT variables and performance of recommended health behaviors (Figure 6-B), would also be tested in a second analysis.

Power analyses were computed for both univariate correlational analyses and multiple regression analyses. A sample size of 155 participants with complete data yields power of .80 to detect an expected medium effect size of 0.22 at $\alpha = .05$ (two-tailed). A second power analysis for the proposed regression analyses was based on two steps with one variable each where each step explains 10% of the variance, followed by a two-variable interaction term that explained an additional 5% of the variance. A sample size of 155 participants with complete data yields power of .89 to detect the 5% increase on the interaction step at $\alpha = .05$ (two-tailed).

Results

Participants

A total of 498 breast cancer patients were screened for eligibility. Of these patients, 163 were ineligible (see Figure 7). Questionnaires and consent forms were mailed to the remaining 326 women; of these women 66 refused to participate, 60 could not be reached, 60 indicated interest in participating but did not return study materials after 3 reminder phone calls, and an additional 10 were ineligible before consent (e.g., indicated that they did not speak English, could not provide consent, etc.). Consent forms were signed by 160 women. Three were ineligible after consent due to other cancer diagnoses and two did not provide complete data, leaving 155 participants in the study sample. The overall response rate of the patients who were mailed study materials was 47.5%. Participants ranged in age from 30 to 87 years old (M = 58.83, SD = 11.83). The majority of the participants had completed at least some college or specialized training (80%), were married (69%), had a gross annual income greater than $40,000 (71%), and were Caucasian (90%). The sample included both Stage I (61%) and Stage II (39%) patients who were an average of 1.45 years (SD = 0.34) since diagnosis and 1.04 years (SD = 0.36) since treatment completion. See Table 1 for complete demographic and clinical information. Participating patients were compared to non-responders on clinical characteristics. There was a trend for responders to have more time passed since diagnosis (p = .06). Also, responders had significantly (p's < .05) more time since

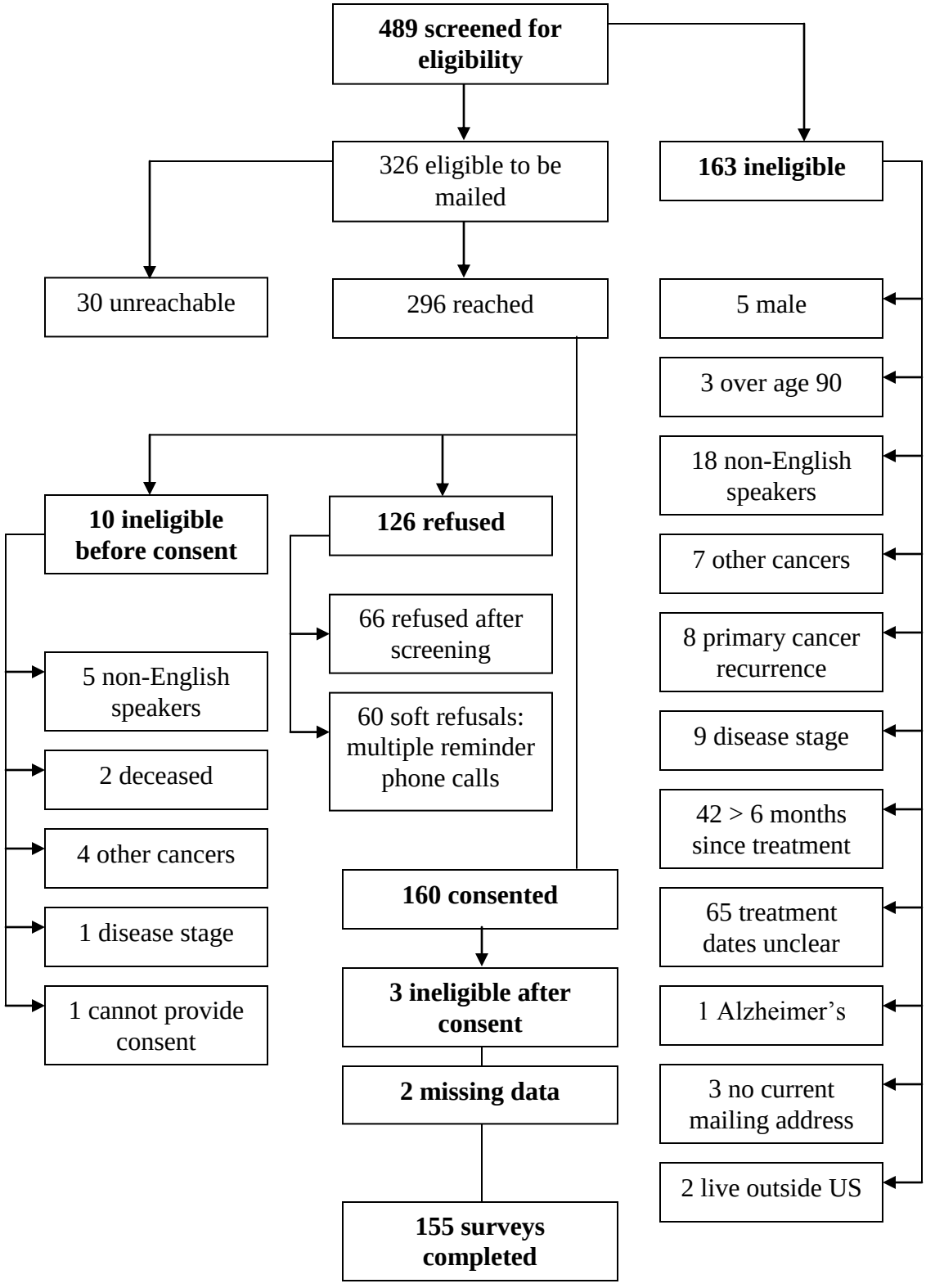

Figure 7. Response rate throughout recruitment and surveying process.

Table 1

Sample Characteristics (N = 155)

Age (*M, SD*)	58.8	11.83
Body Mass Index (*M, SD*)	27.3	5.23
	n	*%*
Race		
Caucasian	140	90.3
African American	7	4.5
Asian	2	1.3
Pacific Islander	2	1.3
American Indian	1	0.7
Other	3	1.9
Ethnicity		
Hispanic	10	6.5
Non-Hispanic	145	93.5
Marital Status		
Single	11	7.1
Married	107	69.1
Separated	5	3.2
Divorced	18	11.6
Widowed	14	9.0
Education		
Less than high school	6	3.8
High school	25	16.1
Some college	59	38.1
College graduate	37	23.9
Graduate degree	28	18.1
Annual Income		
< $40,000	43	28.9
> $40,000	106	71.1
Treatment		
Radiation	47	30.3
Chemotherapy	31	20.0
Chemo & Radiation	34	21.9
Surgery Only	43	27.8
Adjuvant Hormone Therapy	126	81.3
Surgery Type		
Excisional Biopsy	1	0.7
Lumpectomy	69	44.5
Mastectomy	85	54.8
Stage at diagnosis		
Stage I	95	61.3
Stage II	60	38.7

treatment completion, were more likely to have used hormone therapy for breast cancer, and were less likely to have had a lumpectomy as surgical treatment than non-responders.

Descriptive Statistics

Overall, the sample reported a mean fear of recurrence of 1.74 (*SD* = 0.71), which corresponds to reporting experiencing thoughts or difficulties due to concerns about cancer coming back between *not at all or rarely* (1) and *sometimes* (2). For perceived risk, responses for absolute and relative risk estimates were combined on a scale that ranged from 11-60, with higher scores indicating more perceived risk. Participants overall indicated moderate perceived risk of recurrence, with the majority of responses (51%) falling between *somewhat unlikely* (3) to *somewhat likely* (4) for absolute risk. The majority of responses (65%) were *about the same* (3) for relative risk when comparing risk of recurrence to other breast cancer patients. Perceived severity was also moderate (*M* = 22.15, *SD* = 4.54) in this sample as scores fell near the midrange on this measure (possible range = 9 to 30). Mean self-efficacy scores fell near the midrange for diet, (*M* = 178.90, *SD* = 57.47; possible range = 0 to 300) and for exercise (*M* = 96.96, *SD* = 42.63; possible range = 0 to 180). The majority of participants reported agreeing that the American Cancer Society guidelines for diet (68% agree or strongly agree) and exercise (57% agree or strongly agree) could reduce their risk of a cancer recurrence. Finally, 41% of participants reported that they met ACS guidelines for daily fruit and vegetable intake and 37% reported that they met ACS guidelines for weekly physical activity.

Table 2

Relationships of Demographic and Clinical Variables to Outcomes

	Fear of Recurrence		Daily Fruit & Vegetable Intake		Weekly Exercise	
	r		*r*		*r*	
Age	-.25**		-.17*		-.13	
Body Mass Index	-.05		.02		-.20*	
	M	*SD*	*M*	*SD*	*M*	*SD*
Race						
Caucasian	6.89	2.72	5.55[a]	4.84	26.29	21.44
Other	7.73	3.77	9.14	10.04	19.13	17.68
Ethnicity						
Hispanic	6.60	2.27	6.15	4.57	25.70	20.93
Non-Hispanic	6.99	2.87	5.88	5.40	25.59	21.25
Marital Status						
Married	7.14	2.86	5.56	4.71	24.95	20.58
Not married	6.58	2.77	6.63	6.52	27.04	22.56
Education						
Less than college	7.23	2.87	6.03	4.50	20.97	23.29
College graduate	6.90	2.83	5.86	5.54	26.76	20.53
Annual Income						
< $40,000	6.86	2.96	6.73	6.64	27.34	25.51
> $40,000	6.92	2.75	5.66	4.84	24.98	19.64
Treatment						
Radiation	6.70	2.62	5.87	6.47	24.55	22.72
Chemotherapy	7.35	3.16	6.11	4.15	24.58	21.80
Chemo & Radiation	7.15	2.91	5.70	4.50	24.88	19.56
Surgery alone	6.84	2.81	5.92	5.49	28.05	20.69
Surgery Type						
Bilateral Mastectomy	7.43	3.10	6.08	5.66	24.06	20.26
Other surgery	6.75	2.69	5.81	5.20	26.31	21.62
Stage at diagnosis						
Stage I	6.59[b]	2.52	5.66	5.19	26.41	21.43
Stage II	7.57	3.20	6.26	5.58	24.31	20.84

Note. [a] $F(1, 153) = 6.37$, $p = .02$.
[b] $F(1, 153) = 4.47$, $p = .04$.
*$p < .05$, **$p < .01$.

Preliminary Analyses

Relationships between the outcome variables and demographic and clinical variables are presented in Table 2. Higher fear of recurrence was related to younger age and more advanced disease stage. In addition, more depressive symptoms were related to higher fear of recurrence, $r(153) = .61$, $p < .001$. Consuming more daily fruit and vegetable servings was associated with younger age and being Caucasian, but the race differences were likely due to outliers in the non-Caucasian group on this measure. Engaging in more weekly exercise was related to lower body mass index. No other demographic or clinical variables were related to either fear of recurrence or the diet or PA measures. Interrelationships between Protection Motivation Theory variables and outcome variables are presented in Table 3. Fear of recurrence was related to greater threat appraisal overall, and higher perceived vulnerability and higher perceived severity of a breast cancer recurrence. Higher fruit and vegetable intake was related to greater diet coping appraisal overall and higher diet self-efficacy. Greater exercise was related to greater exercise coping appraisal overall, higher exercise self-efficacy, and higher exercise response efficacy.

Evaluation of Hypothesis 1

Hypothesis 1 stated that the combination of high threat appraisal and low coping appraisal would predict high fear of recurrence. To test hypothesis 1, composite threat appraisal and coping appraisal variables were first computed as described in the statistical analysis section. Hierarchical regression analysis was then conducted to test whether the interaction of threat appraisal and coping appraisal predicted fear of recurrence (see Table 4). Threat appraisal and coping appraisal were entered in the first step, followed by the

Table 3

Correlations of Protection Motivation Theory Variables with Fear of Recurrence, Diet, and Exercise

	Fear of Recurrence	Daily Fruit & Vegetable Intake	Weekly Exercise
Coping	-.11	-	-
Exercise Coping	-.09	-	.26**
Diet Coping	-.11	.23**	-
Response Efficacy	-.04	-	-
Exercise Response Efficacy	-.03	-	.21**
Diet Response Efficacy	-.04	.12	-
Self-Efficacy	-.12	-	-
Exercise Self-Efficacy	-.10	-	.18*
Diet Self-Efficacy	-.11	.22**	-
Threat	.60***	-.03	-.03
Vulnerability	.53***	-.12	-.08
Severity	.48***	.07	.02
Weekly Exercise	.03	.15	-
Daily Fruit & Vegetable Intake	.14	-	.15
Fear of Recurrence	-	.03	.14

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 4

Hierarchical Multiple Regression Analyses Predicting Fear of Recurrence From Threat, Coping, and Threat X Coping Interaction

Predictor	β	ΔR^2	Cumulative ΔR^2	*p*
Step 1		.37	.37	< .001
Threat	.63***			
Coping	.01			
Step 2		.02	.39	.03
Threat X Coping	-.14*			

Note. $F(3, 151) = 31.65$, $p < .001$.
*$p < .05$, **$p < .01$, ***$p < .001$.

threat X coping interaction term in the second step. In the first step, threat appraisal and overall coping appraisal accounted for 37% of the variance in fear of recurrence ($p < .001$). Threat alone accounted for a significant portion of variance ($p < .001$) while coping alone did not. In the next step, the threat X coping interaction term accounted for 2% of the remaining variance ($p = .03$). The slopes of the lines were significantly different from zero and significantly different from each other (p's < .001). The observed direction of the interaction supported hypothesis 1 (see Figure 8). That is, participants who reported both high threat appraisal and low coping appraisal had the highest reported levels of fear of recurrence. When controlling for age and disease stage by entering these variables in the first step, the threat X coping interaction remained significant ($p = .04$).

It should be noted that when depression was added as a control variable in the first step, the threat X coping interaction was no longer significant ($p > .05$).

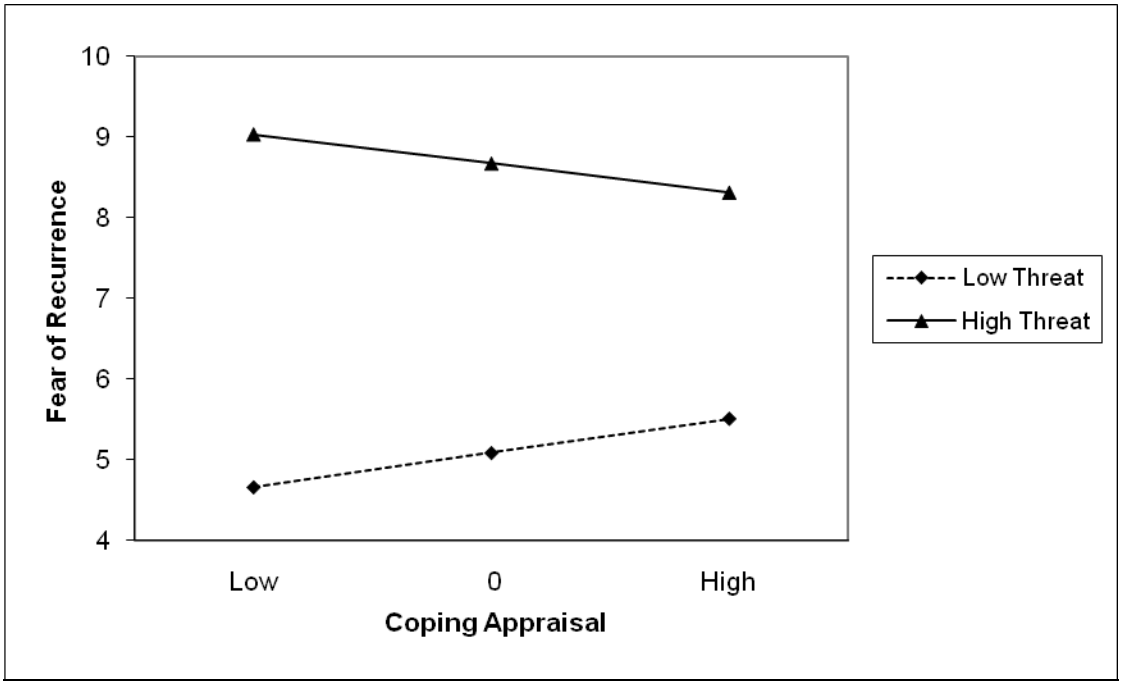

Figure 8. Threat Appraisal X Coping Appraisal Interaction.

Because the threat X coping interaction term contained composite scores, additional analyses were conducted that involved deconstructing the threat appraisal and coping appraisal terms to determine which components were driving the significant interaction. First, exploratory multiple regression analyses were conducted to determine if the threat appraisal portion of the threat X coping interaction term was attributable to perceived vulnerability or perceived severity. Findings were significant only for the perceived vulnerability X coping interaction term. Perceived vulnerability and coping appraisal accounted for 29% of the variance in fear of recurrence ($p < .001$). The addition of the vulnerability X coping interaction term accounted for another 2% of the remaining variance ($p = .02$) (see Table 5). Participants who reported high perceived

Table 5

Hierarchical Multiple Regression Analyses Predicting Fear of Recurrence From Vulnerability, Coping, and Vulnerability X Coping Interaction

Predictor	β	ΔR^2	Cumulative ΔR^2	*p*
Step 1		.29	.29	< .001
Vulnerability	.59***			
Coping	.02			
Step 2		.02	.31	.02
Vulnerability X Coping	-.16*			

Note. $F(3, 151) = 22.80$, $p < .001$.
*$p < .05$, **$p < .01$, ***$p < .001$.

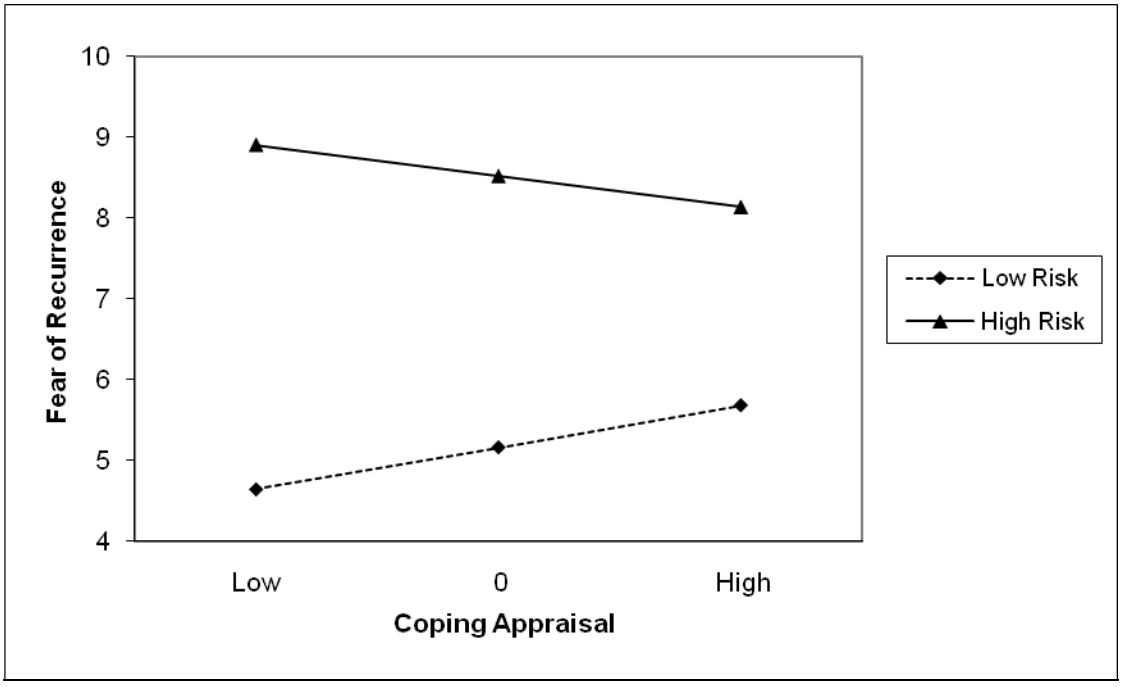

Figure 9. Vulnerability X Coping Appraisal Interaction.

vulnerability and low coping appraisal had the highest levels of fear of recurrence (see Figure 9). Again, when controlling for age and disease stage in the first step, the vulnerability X coping interaction remained significant ($p = .02$).

Exploratory hierarchical multiple regression analyses were then conducted to determine if coping portion of the vulnerability x coping interaction reflected a vulnerability X diet coping interaction or a vulnerability X exercise coping interaction. Only the vulnerability X diet coping interaction was significant. In step 1, vulnerability and diet coping accounted for 29% of the variance in fear of recurrence ($p < .001$). In step 2, the addition of the vulnerability X diet coping interaction term accounted for an additional 3% of the variance ($p = .01$) (see Table 6). Participants who reported high

Table 6

Hierarchical Multiple Regression Analyses Predicting Fear of Recurrence From Vulnerability, Diet Coping, and Vulnerability X Diet Coping Interaction

Predictor	β	ΔR^2	Cumulative ΔR^2	*p*
Step 1		.29	.29	< .001
Vulnerability	.59***			
Diet Coping	.02			
Step 2		.03	.32	.01
Vulnerability X Diet Coping	-.18*			

Note. $F(3, 151) = 23.22$, $p < .001$.
*$p < .05$, **$p < .01$, ***$p < .001$.

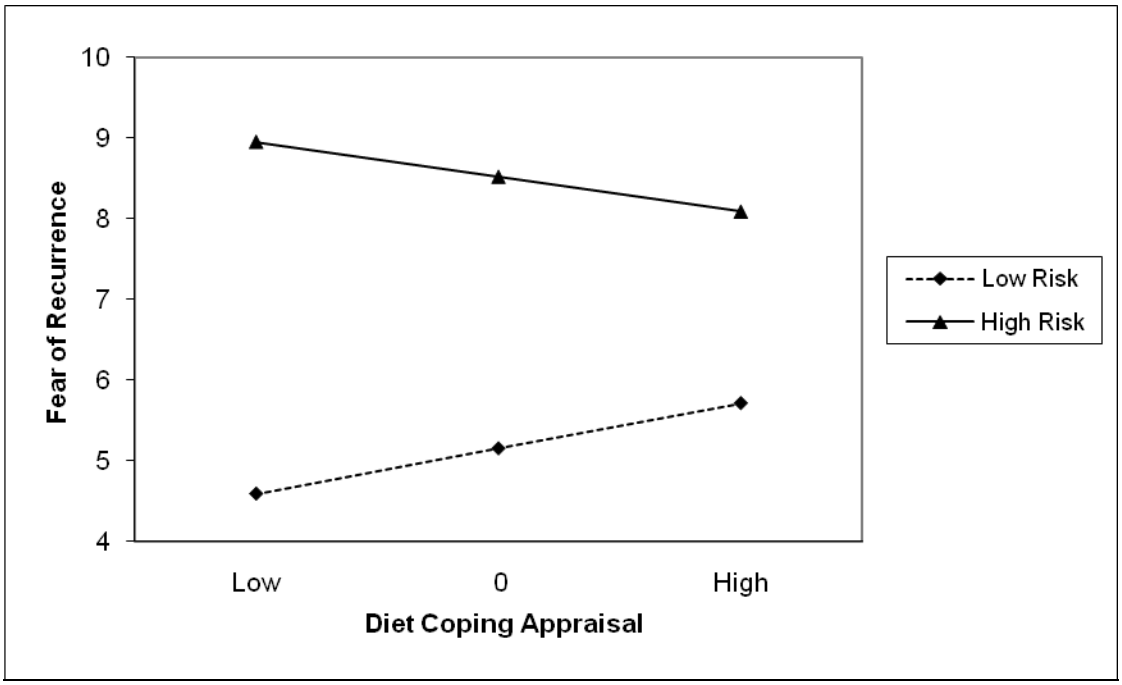

Figure 10. Vulnerability X Diet Coping Appraisal Interaction.

perceived vulnerability and low diet coping appraisal had the highest levels of fear of recurrence (see Figure 10). The interaction remained significant after controlling for age and disease stage ($p = .01$).

Finally, the last set of hierarchical regression analyses determined whether the vulnerability X diet coping interaction was due to the interaction of vulnerability beliefs with diet self-efficacy or with exercise self-efficacy. For diet self-efficacy, the first step was significant with vulnerability and diet self-efficacy accounting for 29% of the variance ($p < .001$). However, the vulnerability X diet self-efficacy interaction was not significant with ($p = .11$) or without age and stage as control variables ($p = .07$), and so did not contribute additional variance to the total variance in fear of recurrence. For diet response efficacy, again, the first step was significant ($p < .001$); vulnerability and diet response efficacy accounted for 29% of the variance in fear of recurrence. However, the

vulnerability X diet response efficacy interaction did not contribute significant variance to the model with (p = .06) or without age and stage as control variables in the first step (p = .07). In summary, these findings indicate that the diet coping portion of the vulnerability X diet coping interaction cannot be further dismantled into significant subcomponents.

Evaluation of Hypothesis 2

Hypothesis 2 stated that the combination of high threat appraisal and high coping appraisal would predict high performance of both healthy diet and PA recommendations from the ACS. To test hypothesis 2, composite threat appraisal and coping appraisal variables were first computed as described in the statistical analyses section. For diet outcomes, hierarchical regression analysis was conducted to test whether the interaction of threat appraisal and diet coping appraisal predicted daily fruit and vegetable intake. Threat appraisal and diet coping appraisal were entered in the first step, followed by a threat X diet coping interaction term in the second step (see Table 7). In the first step, threat appraisal and diet coping appraisal accounted for 11% of the variance in daily fruit and vegetable intake (p < .001). Diet coping alone contributed a significant portion of the variance (p < .001) while threat alone did not. The threat X diet coping interaction term was not significant (p = .98). There was no difference in the significance level when age was controlled for statistically by adding it in the first step. Exclusion of outliers two or more standard deviations from the mean number of fruit and vegetable servings provided no differences in the significance of the findings.

Table 7

Hierarchical Multiple Regression Analyses Predicting Fruit and Vegetable Intake From Threat, Diet Coping, and Threat X Diet Coping Interaction

Predictor	β	ΔR^2	Cumulative ΔR^2	*p*
Step 1		.11	.11	< .001
Threat	.03			
Diet Coping	.33***			
Step 2		.00	.11	.98
Threat X Diet Coping	-.00			

Note. $F(2, 152) = 9.19$, $p < .001$.
*$p < .05$, **$p < .01$, ***$p < .001$.

Similarly, for the logistic regression analysis for adherence to ACS diet guidelines, threat appraisal and diet coping were entered in the first step, followed by a threat X diet coping interaction term in the second step. Threat appraisal and diet coping appraisal were not significant predictors on the first step $\chi^2(2, N = 155) = 3.73$, $p = .16$. The threat X diet coping interaction term in the second step was also not significant $\chi^2(1, N = 155) = 2.01$, $p = .16$. Hence, the threat X diet coping interaction did not predict ACS diet guideline adherence.

For PA outcomes, hierarchical regression analysis was used to test whether the interaction of threat appraisal and exercise coping appraisal predicted weekly exercise. Threat appraisal and exercise coping appraisal were entered in the first step, followed by a threat X exercise coping interaction term in the second step (see Table 8). Threat

appraisal and exercise coping appraisal accounted for 19% of the variance in weekly exercise ($p < .001$). Exercise coping alone added significant variance to the model ($p < .001$) while threat alone did not. The threat X exercise coping interaction term was not significant ($p = .58$). Again, excluding outliers (values two or more standard deviations from the mean) and adding BMI as a potential control variable in the first step did not change the significance of the findings.

Table 8

Hierarchical Multiple Regression Analyses Predicting Weekly Exercise From Threat, Exercise Coping, and Threat X Exercise Coping Interaction

Predictor	β	ΔR^2	Cumulative ΔR^2	*p*
Step 1		.19	.19	< .001
Threat	.06			
Exercise Coping	.45***			
Step 2		.00	.19	.58
Threat X Exercise Coping	.04			

Note. $F(2, 152) = 17.85$, $p < .001$.
*$p < .05$, **$p < .01$, ***$p < .001$.

The logistic regression analysis for adherence to ACS PA guidelines entered threat appraisal and exercise coping appraisal in the first step followed by a threat X exercise coping interaction term in the second step. Threat appraisal and exercise coping appraisal were significant predictors in the first step $\chi^2(2, N = 155) = 29.42$, $p < .001$. Exercise coping accounted for significant predictive value ($p < .001$) while threat did not

(p = .10). The threat X exercise coping interaction term in the second step was not significant $\chi^2(1, N = 155) = 0.38$, p = .54. Hence, the threat X exercise coping interaction did not predict ACS PA guideline adherence.

Exploratory Analyses

Exploratory analyses were conducted to test for interrelationships among threat and coping appraisal, health behaviors, and fear of recurrence to determine whether further analyses should be conducted to evaluate mediation pathways between these variables. Initial univariate analyses showed that there was no correlation between fear of recurrence and performance of health behaviors for diet $r(153) = .14$, p = .07, or PA, $r(153) = .03$, p = .72. Hence, conditions did not exist to test whether health behaviors mediated the relationship between threat and coping appraisal and fear of recurrence, or whether fear of recurrence mediated the relationship between threat and coping appraisal and performance of health behaviors.

Discussion

Relationship of Threat and Coping Appraisal to Fear of Recurrence

Results from this study supported the hypothesis that the combination of high threat appraisal and low coping appraisal would predict greatest fear of recurrence in early stage breast cancer survivors. To better understand which variables were driving this significant interaction, the threat and coping variables were broken down into their component variables. Based on the analyses breaking down threat appraisal, perceived vulnerability to a cancer recurrence appeared to contribute more to the interaction than perceived severity of a recurrence. Also, after dismantling coping appraisal, diet coping was more influential than exercise coping and significantly interacted with perceived vulnerability to predict cancer recurrence fears. When the two subcomponents of diet coping were further dismantled, neither diet self-efficacy nor diet response efficacy had significant interactions with perceived vulnerability.

These findings provide new insight into the prediction of fear of recurrence. Most fear of recurrence research to date has been guided by demographic, clinical, or psychosocial variables as predictors, often neglecting how these various separate factors interact to moderate the levels of fear experienced by cancer survivors. The observed relationship between threat appraisal and fear of recurrence is consistent with Protection Motivation Theory, which stipulates that perceived threats to health should predict fear associated with that health threat (Rippetoe & Rogers, 1987). It is also consistent with

previous research using PMT that found direct relationships between both vulnerability and severity predicting health fears (Helmes, 2002; Maddux & Rogers, 1983). However, the current study also found evidence of an interaction between threat appraisal and coping appraisal predicting fear of recurrence. This finding is consistent with the Extended Parallel Process Model which predicts that coping appraisals moderate the effects of threat appraisal on fear with the highest levels of fear associated with high threat appraisal in combination with low coping appraisal (McCaul & Mullens, 2003; Witte, 1992; Witte, 1998). As can best be determined, this is the first research to show that the combination of high threat and low coping appraisal is related to greater fear of cancer recurrence.

One issue complicating the interpretation of the observed interaction is the relationship of depression to fear of recurrence. Analyses indicated that higher levels of depressive symptomatology were strongly related to greater fear of recurrence. Accordingly, when depression was added as a predictor of fear of recurrence, the interaction between threat and coping appraisal was no longer significant. More research is needed to understand the connection between recurrence fears and depression in cancer survivors. It may be the case that depression influences the occurrence of cancer-related fears. A recently published longitudinal study of cancer-related fear of the future (a concept closely related to, but more broad in scope than fear of cancer recurrence) found that distress levels predicted later fear, but that fears did not affect later distress (Lebel, Rosberger, Edgar, & Devins, 2009). The current pattern of results might also be interpreted to suggest that fear of recurrence is not distinct from depression or that current

measures of fear of recurrence do not do a good job of discriminating between fear of recurrence and depression.

Overall, the reports of fear of recurrence in the present sample of breast cancer survivors were similar to those found in previous studies, with most survivors reporting fears or concerns at least sometimes (Baker et al., 2005; Bluman, Borstelmann, Rimer, Iglehart & Winer, 2001; Deimling et al., 2006; Herschbach et al., 2004; Schroevers et al., 2006; Stanton et al., 2006; van den Beuken-van Everdingen et al., 2008). Therefore, the data seem to reflect typical levels of fear of recurrence in early-stage cancer survivors and suggest that the findings are generalizable to other breast cancer survivors.

Relationship of Threat and Coping Appraisal to Health Behaviors

Results did not support the second study hypothesis that the combination of high threat appraisal and high coping appraisal would predict more consumption of fruits and vegetables, and greater exercise, as well as better adherence to ACS recommendations for cancer survivors regarding diet and exercise. There was evidence, however, of a main effect for coping appraisal but not threat appraisal on these outcomes. Specifically, greater coping appraisal was related to greater daily fruit and vegetable intake and greater weekly exercise, as well as to higher adherence rates for both behaviors. Results of univariate analyses suggested that these relationships reflect positive relationships of response efficacy and self-efficacy with exercise and a positive relationship of self-efficacy but not response efficacy with fruit and vegetable intake.

There are several possible explanations for the lack of support for the hypothesis that the combination of high threat appraisal and high coping appraisal would predict healthier behavior. In the case of the current study, where the focus was on general

health behaviors that are not specific to cancer, participants may have had several reasons for their patterns of health habits other than reducing their risk of cancer. That is, people may follow healthy diets or exercise regimes for several reasons unrelated to concerns about cancer. Possibilities include weight and appearance concerns, convenience, general health knowledge, comorbid illnesses that might make certain activities more difficult, or simply established health habits (Baranowski, Cullen, & Baranowski, 1999; Sherwood & Jeffery, 2000; Trost, Owen, Bauman, Sallis, & Brown, 2002). Because we did not assess these habits before cancer diagnosis, we cannot ascertain how much these behaviors were influenced by the experience of cancer itself. Our finding that neither perceived vulnerability nor perceived severity of a cancer recurrence predicted either health activity suggests a limited impact of the threat of cancer in predicting cancer survivors' current health behaviors. Although participants in the current study reported agreeing that following ACS guidelines can help reduce their risk of future cancer, it was not clear how much they expected their risk to be reduced if they followed those recommendations. If they only anticipated a marginal reduction in risk, patients may not be persuaded to engage the effort necessary to change established health habits.

Another possible explanation for the negative findings may be differences in adherence rates between the current sample and prior study samples. Adherence to recommended fruit and vegetable consumption appeared to be more common in this sample than what was found in earlier studies of breast cancer survivors; roughly 18% of survivors were classified as adherent in previous studies versus 41% adherent in the present study (Blanchard et al., 2008; Meyer et al., 2007). Higher rates of adherence in this study sample might indicate measurement error or a sample that may not represent

typical breast cancer survivors. However, adherence to recommended levels of exercise in the current sample were similar to other studies of cancer survivors, with the rate in the current study (37%) falling somewhere between the 30% to 45% adherence rates reported in previous research (Blanchard et al., 2008; Coups & Ostroff, 2005; Meyer et al., 2007). Therefore, systematic differences in adherence rates in the study sample do not appear to explain the lack of support for an interaction between threat and coping appraisal predicting exercise.

The relationships observed in the current study between Protection Motivation Theory variables and health behaviors confirm some findings from previous studies. Consistent with the present study, several studies have found that coping appraisal beliefs, such as self-efficacy and response efficacy beliefs, predicted health behaviors (Floyd et al., 2000; Maddux & Rogers, 1983; Milne et al., 2000; Lewis et al., 2002; Rippetoe & Rogers, 1987; Seydel et al., 1990; Sheeshka et al., 1993; Stanley & Maddux, 1986). However, other findings are inconsistent with prior research. Although several studies have found associations between threat appraisal and health behaviors such as smoking cessation and increased exercise in healthy subjects (Courneya & Hellsten, 2001; Greenwald, 1997), threat appraisal was not related to diet or exercise behaviors in this study of cancer survivors. As noted previously, the lack of a relationship between threat appraisal and health behaviors in the present study may be due to health behaviors having already changed after cancer diagnosis.

Evidence for Meditational Pathways

Finally, this investigation examined possible interrelationships between PMT variables, fear, and health behaviors. The proposed meditational models were based on

the expectation that there would be significant positive relationships between fear of recurrence and health behaviors. Results provided no evidence of these relationships, and, therefore, full testing of the models was not undertaken. There are several possible reasons why relationships between fear of recurrence and health behaviors were not found. One possibility is related to the fact that most survivors in the study endorsed only occasionally thinking about or being concerned that their cancer would return. Because the levels of fear of recurrence were fairly low overall, they may have been too low to motivate participants to engage in greater exercise or fruit and vegetable intake. The possibility also exists that participants higher in fear of recurrence may have been more likely to engage in other types of health behaviors that were not studied. These include activities like increased contact with medical professionals and better adherence to cancer screening regimens. Prior literature has also often failed to establish links between the fear or arousal associated with health threats and performance of behaviors aimed at reducing the likelihood of the threat (Bowen et al., 2004; McCaul, Branstetter, O'Donnell, Jacobson, & Quinlan, 1998). However, Maunsell et al. (2002) did find a positive relationship between behavior change and distress, especially for diet. Also, Pinto et al. (2002) found that initial depression predicted greater increases in physical activity over the first year after diagnosis, indicating that psychological distress can be related to later health behaviors in cancer survivors. We did not assess health behavior change, however, so further study is required to replicate these findings that link distress to health behaviors.

Limitations

There are several limitations to note in this study. The sample included only breast cancer survivors with early stage disease; consequently, findings may not be generalizable to survivors of other types of cancer and survivors with more advanced disease. Also, because the data were cross-sectional, the direction of the observed relationships remains unclear. Although the data suggest that threat and coping appraisal influenced fear of recurrence, it is also possible that fear of recurrence influenced threat and coping appraisal. Similarly, for health activities, it is not clear if coping appraisal affected performance of healthy behaviors or if performance of healthy behaviors affected coping appraisal.

In addition, this study had some limitations with regard to measurement. First, the use of single-item measures to assess absolute risk, relative risk, and response efficacy raises concerns about the reliability of the information obtained. Second, the strong observed correlation between depression and fear of recurrence suggests that these constructs may be difficult to distinguish with the measures used. Third, there are several problems associated with the use of retrospective self-reports of diet and exercise, including recall bias, confusion understanding serving portion sizes in reporting diet, and positive impression management to report better health habits. Fourth, while fruit and vegetable intake were evaluated to assess diet recommendation adherence, participants answered items about response efficacy and self-efficacy to follow a diet that included limited amounts of red and processed meats, and high levels of whole wheat consumption. Finally, change in health behaviors since diagnosis was not evaluated, so it

is unclear whether the health habits reported reflected changes influenced by cancer-related concerns or were just part of life-long habits.

Clinical Implications & Future Directions

There are several clinical implications of this investigation. First, based on the high correlation between fear of recurrence and depression, patients who report moderate levels of fear of recurrence should also be assessed for possible depression. Second, the interaction of threat and coping appraisal predicting fear of recurrence highlights the importance of both perceptions of threat and perceptions of potentially adaptive coping strategies in determining which survivors will report the highest levels of fear. Future interventions should incorporate strategies to both reduce perceived threat to more realistic levels and to increase survivors' coping appraisal, especially by increasing self-efficacy to perform various healthy behaviors. Third, when creating interventions to promote healthy behaviors in cancer survivors, clinicians should focus on increasing self-efficacy and response efficacy for the target behaviors. Because there was no link between fear of recurrence and health behaviors, the use of scare tactics to encourage behavior change may not be effective. Instead, enhancing competence to perform the behaviors and providing information to help survivors understand what they could be doing to reduce their cancer risk are potentially better strategies.

Future research should also determine whether the observed relationships hold in other samples of cancer survivors including different cancer types and survivors of more advanced disease. Research should also examine relationships between PMT variables and health behavior change over time in order to determine if the same relationships hold when predicting rates of behavior change at various points in cancer survivorship.

Additional health behaviors should be included as outcomes variables, including both those with empirical support that they reduce cancer mortality risk (e.g., cancer screening) and those without (e.g., popular herbal remedies and other alternative medicines). It is important to elucidate the causal nature of these relationships to further determine which modifiable factors lead to both increased fears and increased performance of health behaviors in cancer survivors. Enhanced knowledge of the variables that contribute to these outcomes could assist in the development of interventions to improve quality of life during survivorship.

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