

Published in final edited form as:

Psychooncology. 2012 April ; 21(4): 427–435. doi:10.1002/pon.1925.

Breast Cancer Recurrence Risk Reduction Beliefs in Breast Cancer Survivors: Prevalence and Relation to Behavior

Jessica L. Burris^{1,2}, Paul B. Jacobsen^{3,4}, Loretta S. Loftus⁵, and Michael A. Andrykowski¹

¹ Department of Behavioral Science, University of Kentucky College of Medicine, Lexington, KY

² Department of Psychology, University of Kentucky College of Arts and Sciences, Lexington KY

³ Health Outcomes and Behavior Program, H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL

⁴ Departments of Psychology and Interdisciplinary Oncology, University of South Florida, Tampa, FL

⁵ Comprehensive Breast Program, H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL

Abstract

Objective—There is a growing body of evidence suggesting breast cancer (BC) recurrence risk might be linked to behavioral factors. However, little is known about BC survivors' beliefs regarding the link between their behavior and recurrence risk. The objective of this study was to describe BC survivors' beliefs regarding performance of behaviors potentially associated with BC recurrence risk reduction, and to examine the link between these behaviors and BC recurrence risk reduction beliefs, worry, and risk perception.

Methods—200 female BC survivors (age, years: mean = 57.7, standard deviation = 9.2) completed a questionnaire assessing beliefs about the effectiveness of 14 potential BC recurrence risk reduction behaviors, their performance of these potential risk reduction behaviors, recurrence worry, and perception of personal lifetime BC recurrence risk.

Results—The behaviors most frequently endorsed as potentially reducing BC recurrence risk included avoiding tobacco use (84%), exercising at least three times per week (74%), eating an average of five servings a day of fruits and vegetables (72%), and limiting food intake to maintain current weight or lose weight (70%). Multivariate logistic regression analyses predicting behavioral performance showed that beliefs were consistently associated with behavior while worry and risk perception were largely unrelated to behavior.

Conclusions—BC survivors' beliefs about the effectiveness of potential BC recurrence risk reduction behaviors are largely consistent with empirical findings and relate strongly to actual behavioral performance. Misconceptions about the effects of behavior to reduce BC recurrence risk are important targets for clinical and public health efforts.

Keywords

cancer; oncology; recurrence; prevention and control; behavior; survivors

Introduction

Risk for breast cancer (BC) recurrence is not inconsequential. Women diagnosed with stage 0-III BC treated with surgery plus adjuvant or neoadjuvant therapy have a BC recurrence risk of 6-13% [1-3]. Given this risk of BC recurrence, it is not surprising many BC survivors worry about the possibility of their BC recurring [4-7].

There is a growing body of evidence suggesting BC recurrence risk might be linked to behavioral factors. In particular, obesity, exercise, alcohol use, and diet have been associated with BC recurrence risk in some research. Maintaining a healthy weight [8,9], getting regular physical activity [9-11], consuming no more than three alcoholic drinks per day [12], reducing dietary fat consumption [13], and consuming the recommended daily number of fruits and vegetables [9], either individually or combined, may significantly reduce BC recurrence risk.

In addition to behaviors for which there is empirical support for a protective effect against BC recurrence, there are other behaviors BC survivors might engage in due to their belief these behaviors might also reduce BC recurrence risk. For example, a study of long-term BC survivors found use of “complementary therapies,” such as prayer, humor, and yoga, was common and positively associated with a belief in the ability of these behaviors to reduce BC recurrence risk [14]. In sum, whether supported by research evidence or not, BC survivors are likely to perform some behaviors and avoid other behaviors due to the belief their actions will reduce their BC recurrence risk.

Performance of potential BC recurrence risk reduction behaviors is likely associated with a diverse set of factors including beliefs, recurrence worry, and perceptions of recurrence risk. First, behavioral performance should be positively associated with a belief in the effectiveness of that behavior to reduce BC recurrence risk. As noted above, research with BC survivors has found a positive association between beliefs in the effectiveness of a behavior to reduce BC recurrence risk and actual performance of that behavior [14]. Furthermore, the extent to which a cancer survivor worries about their recurrence risk should motivate action to reduce recurrence risk. In a study of colorectal cancer survivors, cancer worry did in fact predict greater intentions to change behaviors in the areas of diet, exercise, weight loss, complementary therapies, and cigarette smoking [15]. (Cancer survivors' belief that these behaviors affected their recurrence risk was not assessed, however.) Finally, perceptions of recurrence risk should be associated with performance of risk reduction behavior. In general, a stronger perception one is at risk for a negative health event (e.g., BC recurrence) should motivate behavior that is aimed at reducing one's risk. For example, in tobacco-related cancer survivors, Hay et al. (2007) found perceptions of risk for cancer recurrence or development of a second primary cancer predicted subsequent cigarette smoking behavior; survivors with stronger risk perceptions were more likely to abstain from smoking [16].

Given certain behaviors may influence BC recurrence risk, it is important to understand factors that motivate performance of potential BC risk reduction behaviors. The current study aims are twofold: (1) to examine BC recurrence risk reduction beliefs in a recurrence free sample of BC survivors, and (2) to identify the relationship between performance of potential BC recurrence risk reduction behaviors and BC recurrence risk reduction beliefs, worry about BC recurrence, and perceptions of personal risk for BC recurrence. We hypothesized performance of potential BC recurrence risk reduction behaviors would be positively associated with beliefs in the effectiveness of those behaviors to reduce recurrence risk, worry about recurrence, and recurrence risk perception.

Methods

Participants

Participants were participating in a longitudinal study of physical and psychosocial outcomes in women receiving adjuvant treatment for early stage BC (i.e., parent study). Participants were enrolled in the parent study at the H. Lee Moffitt Cancer Center at the University of South Florida (USF) or the Markey Cancer Center at the University of Kentucky (UK) following BC diagnosis but prior to initiation of adjuvant treatment. Detailed descriptions of enrollment and assessment procedures for the parent study can be found elsewhere [17-19]. Briefly, study eligibility criteria were: (1) ≥ 18 years of age, (2) stage 0-II BC, (3) scheduled to receive adjuvant chemotherapy (CT), radiotherapy (RT) or both (CT+RT), (4) no psychiatric or neurologic disorder that would interfere with study participation, (5) ability to speak, read, and understand English, (6) no history of cancer other than basal cell skin carcinoma, (7) no concurrent chronic or life-threatening disease in which fatigue is a potentially prominent symptom (e.g., multiple sclerosis), and (8) provision of informed consent.

Procedure

Study procedures were approved by the USF and UK Institutional Review Boards. Potential participants were identified daily from clinic rosters followed by a review of medical records and consultation with clinic staff. They were recruited during a clinic visit following BC surgery but prior to the start of adjuvant therapy. Participants completed a series of assessments, consisting of clinical interviews and questionnaires, prior to and during adjuvant treatment as well as 6 and 42 months following conclusion of adjuvant treatment. The current data were obtained at the 42 months post-treatment assessment. The 42 months post-treatment assessment was usually completed in-person, but due to scheduling difficulties, in a few instances, the assessment was completed by a participant at home using a combination of mail and telephone data collection methods. Demographic information regarding birth date, race/ethnicity, partner status, and education was obtained from participants at the time of enrollment in the parent study. Medical information regarding stage of disease, surgery, and adjuvant therapy was obtained from medical records.

Measures

BC Recurrence Risk Reduction Beliefs and Behavior—Participants were given a list of 14 behaviors that BC survivors might engage in to reduce BC recurrence risk (e.g., avoid any tobacco use, take herbal supplements or remedies, pray regularly). The complete list of 14 behaviors is shown in Table 2. For each behavior, BC recurrence risk reduction beliefs (Beliefs) associated with that behavior and performance of that behavior in the past month (Behavior) were assessed. Beliefs regarding behaviors potentially associated with BC recurrence risk reduction were assessed by asking participants to indicate “the extent to which you believe each of the following might be effective in reducing your risk of being diagnosed with breast cancer again.” Three response options were provided: “Yes, I believe it can reduce my breast cancer risk,” “No, I don't believe it would reduce my breast cancer risk,” and “I am not sure if it would reduce my breast cancer risk.” Behavior was assessed by asking participants to indicate “whether or not you have done any of the following in the past month.” Three response options were provided including “Yes, I have done this in the past month,” “No, I have not done this in the past month, but I have an interest in doing this,” and “No, I have not done this in the past month, and have no interest in doing this.”

BC Recurrence Worry—BC recurrence worry (Worry) was assessed using a 4-item scale that was adapted from two similar measures used to assess worry about a primary BC diagnosis [20,21]. The four items included: (1) “How often have you been concerned about

getting breast cancer again?” (2) “How often have you thought about your own chances of having breast cancer again?” (3) “How often have thoughts about breast cancer affected your mood?” and (4) “How often have thoughts about breast cancer affected your ability to perform your daily activities?” For each question, participants described their experience during the last month using a 4-point Likert scale with response options ranging from 1 = “not at all or rarely,” 2 = “sometimes,” 3 = “often,” and 4 = “a lot.” Individual scores for the four items were summed to create a total Worry score. Coefficient alpha for the 4-item scale was .79.

BC Recurrence Risk Perception—Two items were used to assess perceptions of personal lifetime risk for BC recurrence. These items were based upon prior research assessing perceptions of risk for a variety of health hazards, including a primary cancer diagnosis [22-24]. Absolute BC recurrence risk perception was assessed by the item “How likely do you think you are to have breast cancer again during your lifetime?” Responses were obtained on a 6-point Likert scale with response options ranging from 1 = “extremely unlikely” to 6 = “extremely likely.” Relative BC recurrence risk perception was assessed by the item “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 have received the same treatment for the same type of breast cancer?” Responses for this item were obtained on a 5-point Likert scale with response options ranging from 1 = “much lower” to 5 = “much higher.” Higher scores on both items indicated perceptions of greater personal lifetime risk for BC recurrence. A composite index of BC recurrence risk perception (Risk Perception) was created by converting responses on the two individual items to z-scores and then summing the z-scores. Coefficient alpha for the 2-item Risk Perception composite score was .62.

BC Recurrence and Second BC Diagnosis—Whether a woman had experienced a recurrent BC or a second primary BC was assessed by the question “Have you ever been told by a doctor that you had a second breast cancer or a recurrence of your original breast cancer?” Response options included “no,” “yes, a second breast cancer,” and “yes, a recurrence of the original breast cancer.”

BC Recurrence Risk Reduction Treatment—Receipt of BC recurrence risk reduction surgery was assessed by two questions: (1) “Since your BC diagnosis, have you had surgery to remove a breast that did not have cancer?” and (2) “Since your BC diagnosis, have you had surgery to remove your ovaries?” Response options were “yes” and “no.” Current use of BC recurrence risk reduction prescription medications was assessed by the question, “Are you currently taking any of the following prescription medications used to prevent BC or recurrence of BC?” Women were provided a list of six medications (Tamoxifen, Raloxifene, Anastrozole, Letrozole, Toremifene, Exemestane) and asked to check all they were currently taking. Women could also indicate they were taking one of the medications listed but could not specifically identify which it was.

Data Preparation and Statistical Analysis

Behavior during the past month for each of the 14 potential recurrence risk reduction behaviors was dichotomized as either 1 = “yes” or 0 = “no” by combining the two categories, “no, I have not done this in the past month and have no interest in doing this” and “no, I have not done this in the past month but I have an interest in doing this” into a single “no” category. Responses to the BC recurrence risk reduction belief question for each of the 14 behaviors were transformed into an ordinal variable with three values: 2 = “Yes, I believe it can reduce my breast cancer risk,” 1 = “I am not sure if it would reduce my breast cancer risk,” and 0 = “No, I don't believe it would reduce my breast cancer risk.” The total

score on the 4-item Worry scale was used to index worry about BC recurrence and the 2-item composite measure of BC recurrence risk perception was used to index Risk Perception.

First, the univariate relationships between each of the 14 potential BC recurrence risk reduction behaviors and Beliefs, Worry, and Risk Perception were examined using nonparametric Spearman correlations. Next, the multivariate relationships between each of the 14 potential BC recurrence risk reduction behaviors and Beliefs, Worry, and Risk Perception were examined using a set of 14 multiple logistic regression analyses. The dependent variable in each analysis was the dichotomous measure of behavioral performance as described above. The predictor variables in each analysis were the measures of Beliefs, Worry, and Risk Perception as described above. Of note, in predicting each of the 14 Behaviors, only the Beliefs item that corresponded to the behavior of interest was used (e.g., Beliefs about avoiding any tobacco use was used in the analysis examining the Behavior of avoiding any tobacco use) whereas the same Worry and Risk Perception variables were used in the prediction of all 14 Behaviors. Finally, an additional set of 14 multiple logistic regression analyses were conducted, this time adding interaction terms representing the combination of BC recurrence risk reduction beliefs and recurrence worry (Beliefs \times Worry) as well as BC recurrence risk perception (Beliefs \times Risk Perception). Prior to the construction of the two interaction terms and use in these latter regression analyses, Beliefs, Worry, and Risk Perception variables were all centered.

All statistical analyses were performed using the Statistical Package for the Social Sciences, Release 17.0. The criterion for statistical significance was set at $p < .05$.

Results

Study Sample

A total of 206 participants completed the 42 months post-treatment assessment. Of these, six participants indicated they had been diagnosed with either a recurrent BC or second primary BC; these participants were excluded from all study analyses. Thus, the study sample consisted of 200 recurrence free BC survivors. Participants were drawn from both the USF (n=122; 61%) and UK (n=78; 39%). At the time of the 42 months post-treatment assessment, participants were a mean of 57.7 years of age (standard deviation; SD=9.2 years; range=34-82 years) and 4.1 years post-BC diagnosis (SD=0.3 years; range=4-5 years). See Table 1 for other demographic and clinical characteristics of the sample.

BC Recurrence Risk Reduction Beliefs and Behavior

The number and proportion of participants who endorsed a positive belief (i.e., indicated “yes”) that a particular behavior could reduce BC recurrence risk are shown in Table 2. Behaviors most frequently endorsed as potential BC recurrence risk reduction behaviors were “avoid any tobacco use” (n=168; 84%), “exercise at least 3 times a week for 20-30 minutes” (n=149; 74%), “eat an average of 5 servings a day of fruits and vegetables” (n=144; 72%), and “limit food intake to maintain current weight or lose weight” (n=140; 70%). Behaviors least frequently endorsed as potential BC recurrence risk reduction behaviors included “see a mental health professional” (n=12; 6%), “avoid eating meat of any kind” (n=13; 6%), “receive massage therapy” (n=43; 22%), and “take herbal supplements or remedies” (n=48; 24%).

Participants also endorsed negative beliefs (i.e., indicated “no”) and uncertainty (i.e., indicated “don’t know”) regarding the 14 potential BC recurrence risk reduction behaviors (see Table 2). Behaviors associated with the largest proportion of negative beliefs included “see a mental health professional” (n=106; 53%), “avoid eating meat of any kind” (n=67;

34%), “receive massage therapy” (n=53; 26%), and “take herbal supplements or remedies” (n=47; 24%). Behaviors associated with the largest proportion of uncertainty included “avoid eating meat of any kind” (n=119; 60%), “take herbal supplements or remedies” (n=104; 52%), “receive massage therapy” (n=104; 52%), and “practice yoga or meditation” (n=97; 48%).

Self-reported performance during the past month of each of the 14 potential BC recurrence risk reduction behaviors is shown in Table 2. The most frequently performed behaviors included “pray regularly” (n=164; 83%), “avoid any tobacco use” (n=155; 77%), “take vitamin supplements” (n=151; 75%), and “limit food intake to maintain current weight or lose weight” (n=130; 65%). Conversely, behaviors least frequently performed included “avoid eating meat of any kind” (n=13; 7%), “see a mental health professional” (n=16; 8%), “receive massage therapy” (n=30; 15%), and “practice yoga or meditation” (n=32; 16%).

Relationships between Behavior and BC Recurrence Risk Reduction Beliefs, Worry, and Risk Perception

The univariate relationship between Behavior and Beliefs for each of the 14 potential BC recurrence risk reduction behaviors was examined by Spearman correlation (see Table 3). Behavior was positively correlated with Beliefs for 13 of 14 behaviors. The lone exception was “avoid eating meat of any kind” ($r=.02$, n.s.). Correlations for the remaining 13 behaviors ranged from $r=.18$ (“eat an average of 5 servings a day of fruits and vegetables”) to $r=.54$ (“take herbal supplements or remedies”) with a mean correlation of $r=.32$. The Behaviors most strongly linked to Beliefs included “take herbal supplements or remedies” ($r=.54$), “pray regularly” ($r=.48$), “use relaxation techniques” ($r=.43$), and “take vitamin supplements” ($r=.40$).

The univariate relationships between Behavior and Worry and Risk Perception were also examined by Spearman correlation (see Table 3). The correlation between Behavior and Worry was significant for only 2 of 14 behaviors: “see a mental health professional” ($r=.19$) and “avoid any tobacco use” ($r=-.15$). It should be noted the latter correlation between Behavior and Worry was negative, which means that tobacco use in the past month was associated with greater worry regarding BC recurrence. The correlation between Behavior and Risk Perception was also significant for only 2 of 14 behaviors: “limit food intake to maintain or lose weight” ($r=-.16$) and “see a mental health professional” ($r=.14$). Again, it should be noted that the correlation obtained between limiting food intake and Risk Perception was negative, meaning participants who perceived themselves as having a greater personal lifetime risk for BC recurrence were less likely to limit their food intake. Finally, the Pearson correlation between our measures of Worry and Risk Perception was $.39$ ($p < .001$) suggesting a modest, positive relationship.

The multivariate relationship between performance of potential BC recurrence risk reduction behaviors and Beliefs, Worry, and Risk Perception was examined using 14 multiple regression analyses (see Table 4). The set of three variables accounted for a significant proportion of variance in behavioral performance for 12 of the 14 behaviors examined. The lone exceptions were “avoid eating meat of any kind” and “eat 5 servings of fruits and vegetables daily.” The proportion of explained variance for the remaining 12 behaviors ranged from 5.6% (“exercise 3 times a week for 20-30 minutes”) to 28.9% (“take herbal supplements or remedies”) with a mean of 13.3%. Notably, Beliefs were consistently associated with Behavior while Worry and Risk Perception were largely unrelated to Behavior. In fact, with only two exceptions (“avoid eating meat of any kind” and “wear protective clothing when out in the sun”), Beliefs were a significant predictor of behavioral performance (mean $\beta = .27$, all p 's $< .05$). In contrast, the only behavior that was significantly associated with either Worry or Risk Perception was “avoid any tobacco use” (Worry $\beta =$

16). As was seen in the univariate analysis, greater worry about BC recurrence was associated with a lesser likelihood of avoiding tobacco use.

Finally, the relationship between potential BC recurrence risk reduction behavior and Beliefs, Worry, and Risk Perception was examined using a set of 14 multivariate regression analyses, this time adding interaction terms to the three main effects (Beliefs, Worry, and Risk Perception) included in the analyses described above. Only 3 of 28 potential interaction terms were significant ($p < .05$) suggesting little additional explanatory power was achieved by consideration of interaction terms (results not shown).

Discussion

Results indicate BC survivors possess various beliefs regarding the link between certain behaviors and BC recurrence risk. Encouragingly, behaviors most commonly endorsed by BC survivors as being effective at reducing BC recurrence risk were, generally speaking, those for which empirical evidence supports a linkage (e.g., exercising, maintaining a healthy weight). Some survivors also endorsed beliefs in the effectiveness of certain behaviors to reduce BC recurrence risk for which little or no empirical support currently exists (e.g., wearing protective clothing when in the sun, praying). Finally, some survivors expressed beliefs that certain behaviors are not linked to BC recurrence risk reduction despite emerging evidence for their protective effect (avoiding alcohol). This pattern of findings, whereby BC survivors hold some beliefs that are consistent with empirical research and other beliefs that are inconsistent with empirical research, is similar to that of prior research with gynecologic cancer survivors [25].

Interestingly, our data do not support the existence of any widespread belief among BC survivors regarding the link between formal psychological intervention and BC recurrence risk reduction. Only 6% of our sample indicated “seeing a mental health professional” could reduce their BC recurrence risk. Research examining the link between psychological interventions and biological outcomes in cancer survivors [26-28] has been criticized for creating false and unrealistic expectations in cancer survivors [29,30]. Admittedly, much of this literature has examined the impact of group-based psychological interventions on biological outcomes and we did not assess survivors' beliefs regarding the efficacy of group interventions to reduce BC recurrence risk. However, our data suggest few BC survivors believe at least one specific type of psychological intervention – seeing a mental health professional – can affect one specific type of biological outcome, namely BC recurrence.

Our hypotheses regarding factors associated with performance of potential BC recurrence risk reduction behaviors were only partly supported. Consistent with our hypothesis and prior research [14,25,31], recurrence risk reduction beliefs were positively linked to behavior in both the univariate (Table 3) and multivariate (Table 4) analyses. Contrary to hypothesis, both BC recurrence worry and recurrence risk perception showed little positive relationship to behavior. This was true when these two factors were considered as main effects or in interactions with beliefs regarding the recurrence risk reduction potential of particular behaviors. In fact, in the lone instance when one of these two factors was significantly associated with a specific behavior in both the univariate and multivariate analyses, it was in the negative direction. Specifically, greater BC recurrence worry was associated with less likelihood of avoiding tobacco. As cigarette smoking is used as a coping strategy in the general population [32-34], it is possible that BC survivors use tobacco to cope with recurrence worries.

Why were BC recurrence worry and risk perception largely unrelated to performance of potential recurrence risk reduction behaviors? Several explanations come to mind. While our

measure of BC recurrence worry was a straightforward modification of a commonly used measure of cancer worry [20,21], and our measure of BC recurrence risk perception was based upon two commonly used approaches to assessing cancer risk perceptions [22-24], the absence of psychometric information for our adapted measures means we cannot rule out the possibility that our measures were not reliable enough to provide a sound test of our hypotheses. Second, our hypotheses that BC recurrence worry and risk perception would predict behavior is based on the assumption that women acknowledge a link between their behavior and recurrence risk. However, for 8 of the 14 potential BC recurrence risk reduction behaviors examined, fewer than 50% of our sample endorsed a belief in the link between that behavior and recurrence risk (Table 2). Additionally, the six potential risk reduction behaviors for which over 50% of our sample endorsed a behavior-recurrence risk link included behaviors related to tobacco, diet, weight, and exercise, which are complexly determined and difficult to initiate and maintain. Thus, it is not surprising that performance of these behaviors is sometimes found to be unrelated to potential motivational variables such as worry or risk perception [15,35,36].

Limitations of the current study deserve comment. First, our dichotomous measure of performance of a potential BC recurrence risk reduction behavior within the past month was crude. Additional assessment of frequency and/or intensity of behavior would have been desirable. Second, while we examined the relationship between behavioral performance of potential BC recurrence risk reduction and belief it could modify risk, we did not assess whether a woman performed a behavior with the specific expectation it would reduce her BC recurrence risk. Some of the BC survivors in this study may have reported exercising regularly, avoiding tobacco use, or eating a healthy diet for reasons other than trying to reduce their personal risk for BC recurrence (e.g., efforts to avoid cardiovascular disease). Of note, though, our measure of potential BC recurrence risk reduction behaviors is consistent with previous research in this area [16,37], in that we measured behavioral performance without explicit mention of any attempt to reduce recurrence risk. Finally, our sample consisted primarily of White, non-Hispanic and reasonably well-educated women, which precludes determination of whether study findings might vary across race, ethnicity, and/or socioeconomic status.

In conclusion, our findings have clinical import. Our results suggest a link between BC recurrence risk reduction beliefs and behavior. Thus, efforts to encourage the performance of empirically supported BC recurrence risk reduction behaviors should focus first on establishing appropriate beliefs regarding the link between a particular behavior and recurrence risk. Encouragingly, our data suggest many BC survivors already believe in the recurrence risk reduction potential of several behaviors for which research has provided empirical support. However, promotion of recurrence risk reduction behaviors requires more than simply establishing or strengthening veridical beliefs. Survivors may believe in the BC recurrence risk reduction potential of behaviors for which available evidence does not support such a link or they may possess a firm belief that a behavior is not linked to BC recurrence risk even when the scientific evidence actually supports such a link. Thus clinical or public health efforts to promote evidence-based BC recurrence risk reduction behaviors need to modify incorrect beliefs that might draw survivors' attention and energy away from engaging in behaviors for which empirical support is present. Once appropriate BC recurrence risk reduction beliefs are established, efforts can be directed toward motivating survivors to act upon those beliefs [38,39]. Finally, while our data suggest BC recurrence worry and risk perceptions are largely unrelated to potential BC recurrence risk reduction behavior, future research should seek to identify particular conditions under which these factors might promote or impede the performance of empirically supported BC recurrence risk reduction behaviors.

Acknowledgments

This research was supported by grant R01 CA82822 from the National Cancer Institute.

References

1. Boyages J, Delaney G, Taylor R. Predictors of local recurrence after treatment of ductal carcinoma in situ: A meta-analysis. *Cancer*. 1999; 85:616–628. [PubMed: 10091735]
2. Brewster AM, Hortobagyi GN, Broglio KR, Kau S, Santa-Maria CA, Arun B, et al. Residual risk of breast cancer recurrence 5 years after adjuvant therapy. *J Natl Cancer Inst*. 2008; 100:1179–1183. [PubMed: 18695137]
3. Goodwin A, Parker S, Ghersi D, Wilcken N. Post-operative radiotherapy for ductal carcinoma in situ of the breast. *Cochrane Database Syst Rev*. 2009; 21:CD000563.
4. Deimling GT, Bowman KF, Sterns S, Wagner LJ, Kahana B. Cancer-related health worries and psychological distress among older adult, long-term cancer survivors. *Psycho-Oncol*. 2006; 15:306–320.
5. Mellon S, Gold R, Janisse J, Cichon M, Tainsky MA, Michael A, et al. Risk perception and cancer worries in families at increased risk of familial breast/ovarian cancer. *Psycho-Oncol*. 2008; 17:756–766.
6. Partridge A, Adloff K, Blood E, Dees EC, Kaelin C, Golshan M, et al. Risk perceptions and psychosocial outcomes of women with ductal carcinoma in situ: Longitudinal results from a cohort study. *J Natl Cancer Inst*. 2008; 100:243–251. [PubMed: 18270338]
7. van den Beuken-van Everdingen MHJ, Peters ML, de Rijke JM, Schouten HC, van Kleef M, Patijn J. Concerns of former breast cancer patients about disease recurrence: A validation and prevalence study. *Psycho-Oncol*. 2008; 17:1137–1145.
8. Goodwin PJ, Ennis M, Pritchard KI, Trudeau ME, Koo J, Madarnas Y, et al. Fasting insulin and outcome in early-stage breast cancer: Results of a prospective cohort study. *J Clin Oncol*. 2002; 20:42–51. [PubMed: 11773152]
9. Pierce JP, Stefanick ML, Flatt SW, Natarajan L, Sternfeld B, Madlensky L, et al. Greater survival after breast cancer in physically active women with high vegetable-fruit intake regardless of obesity. *J Clin Oncol*. 2007; 25:2345–2351. [PubMed: 17557947]
10. Holick CN, Newcomb PA, Trentham-Dietz A, Titus-Ernstoff L, Bersch AJ, Stampfer MJ, et al. Physical activity and survival after diagnosis of invasive breast cancer. *Cancer Epidemiol Biomarkers Prev*. 2008; 17:379–386. [PubMed: 18250341]
11. Holmes MD, Chen WY, Feskanich D, Kroenke CH, Colditz GA. Physical activity and survival after breast cancer diagnosis. *JAMA*. 2005; 293:2479–2486. [PubMed: 15914748]
12. Kwan ML, Kushi E, Weltzien E, Castillo A, Caan B. Alcohol consumption and breast cancer recurrence and survival among women with early-stage breast cancer. *Cancer Res*. 2009; 69(24 Suppl) Abstract no. 17.
13. Chlebowski RT, Blackburn GL, Thomson CA, Nixon DW, Shapiro A, Hoy MK, et al. Dietary fat reduction and breast cancer outcome: Interim efficacy results from the Women's Intervention Nutrition Study (WINS). *J Natl Cancer Inst*. 2006; 98:1767–1776. [PubMed: 17179478]
14. Hann D, Baker F, Denniston M, Entekin N. Long-term breast cancer survivors' use of complementary therapies: Perceived impact on recovery and prevention of recurrence. *Integr Cancer Ther*. 2005; 4:14–20. [PubMed: 15695473]
15. Mullens AB, McCaul KD, Erickson SC, Sandgren SK. Coping after cancer: Risk perceptions, worry, and health behaviors among colorectal cancer survivors. *Psycho-Oncol*. 2004; 13:367–376.
16. Hay JL, Ostroff J, Burkhalter J, Li Y, Quiles Z, Moadel A. Changes in cancer-related risk perception and smoking across time in newly-diagnosed cancer patients. *J Behav Med*. 2007; 30:131–142. [PubMed: 17334916]
17. Andrykowski MA, Schmidt JE, Salsman JM, Beacham AO, Jacobsen PB. Use of a case definition approach to identifying cancer-related fatigue in women undergoing adjuvant therapy for breast cancer. *J Clin Oncol*. 2005; 23:6613–6622. [PubMed: 16170168]

18. Donovan KA, Small BJ, Andrykowski MA, Munster P, Jacobsen PB. Utility of a cognitive-behavioral model to predict fatigue following breast cancer treatment. *Health Psychol.* 2007; 26:464–472. [PubMed: 17605566]
19. Jacobsen PB, Donovan KA, Small BJ, Jim HS, Munster PN, Andrykowski MA. Fatigue after treatment for early stage breast cancer: A controlled comparison. *Cancer.* 2007; 110:1851–1859. [PubMed: 17847016]
20. Lerman C, Daly M, Masny A, Balslem A. Attitudes about genetic testing for breast-ovarian cancer susceptibility. *J Clin Oncol.* 1994; 12:843–850. [PubMed: 8151327]
21. Isaacs C, Peshkin BN, Schwartz M, DeMarco TA, Main D, Lerman C. Breast and ovarian cancer screening practices in healthy women with a strong family history of breast or ovarian cancer. *Breast Cancer Res Treat.* 2002; 71:103–112. [PubMed: 11881908]
22. Diefenbach MA, Weinstein ND, O'Reilly JO. Scales for assessing perceptions of health hazard susceptibility. *Health Educ Res.* 1993; 8:181–192. [PubMed: 10148827]
23. Wardle J, Williamson S, Sutton S, Biran A, McCaffery K, Cuzick J, et al. Psychological impact of colorectal cancer screening. *Health Psychol.* 2003; 22:54–59. [PubMed: 12558202]
24. Weinstein D. Unrealistic optimism about susceptibility to health problems: Conclusions from a community-wide sample. *J Behav Med.* 1987; 10:481–500. [PubMed: 3430590]
25. Costanzo ES, Lutgendorf SK, Bradley SL, Rose SL, Anderson B. Cancer attributions, distress, and health practices among gynecologic cancer survivors. *Psychosom Med.* 2005; 67:972–980. [PubMed: 16314603]
26. Andersen BL, Yang HC, Farrar WB, Golden-Kreutz DM, Emery CF, Thornton LM, et al. Psychological intervention improves survival for breast cancer patients: A randomized clinical trial. *Cancer.* 2008; 113:3450–3458. [PubMed: 19016270]
27. Fawzy FI, Canada AL, Fawzy NW. Malignant melanoma: Effects of a brief, structured psychiatric intervention on survival and recurrence at 10-year follow-up. *Arch Gen Psychiatry.* 2003; 60:100–103. [PubMed: 12511177]
28. Spiegel D, Bloom JR, Kraemer HC, Gotthel E. Effect of psychosocial treatment on survival of patients with metastatic breast cancer. *Lancet.* 1989; 2:888–891. [PubMed: 2571815]
29. Boesen EH, Johansen C. Impact of psychotherapy on cancer survival: time to move on? *Curr Opin Oncol.* 2008; 20:372–377. [PubMed: 18525330]
30. Coyne JC, Stefanek M, Palmer SC. Psychotherapy and survival in cancer: The conflict between hope and evidence. *Psychol Bull.* 2007; 133:367–294. [PubMed: 17469983]
31. Patterson RE, Kristal AR, White E. Do beliefs, knowledge, and perceived norms about diet and cancer predict dietary change? *Am J Public Health.* 1996; 86:1394–1400. [PubMed: 8876507]
32. Krueger PM, Chang VW. Being poor and coping with stress: Health behaviors and the risk of death. *Am J Public Health.* 2008; 98:889–896. [PubMed: 18382003]
33. Ng DM, Jeffery RW. Relationships between perceived stress and health behaviors in a sample of working adults. *Health Psychol.* 2003; 22:638–642. [PubMed: 14640862]
34. Steptoe A, Lipsey Z. Stress, hassles, and variations in alcohol consumption, food choice, and physical exercise: A diary study. *Br J Health Psychol.* 1998; 3:51–63.
35. Park CL, Gaffey AE. Relationships between psychosocial factors and health behavior change in cancer survivors: An integrative review. *Ann Behav Med.* 2007; 34:115–134. [PubMed: 17927551]
36. Mosher CE, Lipkus IM, Sloane R, Kraus WE, Clutter Snyder D, Peterson B, et al. Cancer survivors' health worries and associations with lifestyle practices. *J Health Psychol.* 2008; 13:1105–1112. [PubMed: 18987083]
37. Schnoll RA, James C, Malstrom M, Rothman RL, Wang H, Babb J, et al. Longitudinal predictors of continued tobacco use among patients diagnosed with cancer. *Ann Behav Med.* 2003; 25:214–221. [PubMed: 12763716]
38. Bennett JA, Lyons KS, Winters-Stone K, Nail LM, Schrer J. Motivational interviewing to increase physical activity in long-term cancer survivors: A randomized controlled trial. *Nurs Res.* 2007; 56:18–27. [PubMed: 17179870]

39. Campbell MK, Carr C, Devellis B, Switzer B, Biddle A, Amamoo MA, et al. A randomized trial of tailoring and motivational interviewing to promote fruit and vegetable consumption for cancer prevention and control. *Ann Behav Med.* 2009; 38:71–85. [PubMed: 20012809]

Table 1
Clinical and Demographic Characteristics of the Study Sample (n = 200)

Variable	Frequency	Percentage
Disease Stage		
0	23	12
1	108	54
2	69	34
Surgery		
Mastectomy ⁶	25	13
Lumpectomy	175	87
Adjuvant treatment		
Radiotherapy only	80	40
Chemotherapy only	18	9
Radiotherapy and Chemotherapy	102	51
Education		
≤ High school graduate	46	23
Some college	58	29
≥ College graduate	96	48
Annual Household Income		
< \$20,000	10	5
\$20,000 - \$59,999	76	38
\$60,000 - \$100,000	61	30
≥ \$100,101	37	19
Missing	16	8
Married or Partnered	144	72
Race/Ethnicity		
Racial/ethnic minority	19	10
White, non-Hispanic	181	90
Family History of Breast Cancer in First Degree Relative ⁷	44	22
Breast Cancer Recurrence Risk Reduction Treatment		
Prophylactic mastectomy ⁸	6	3
Prophylactic oophorectomy ^a	14	7
Prescription medication ⁹	117	59

⁶Included women who received bilateral mastectomy or lumpectomy plus mastectomy

⁷Reported prior diagnosis of breast cancer in first degree relative (e.g., mother, sister)

⁸Performed following breast cancer diagnosis

⁹Reported current use of one of the following: Tamoxifen, Raloxifene, Anastrozole, Letrozole, Toremifene, Exemestane

Table 2
Breast Cancer Recurrence Risk Reduction Beliefs and Behavior

Behavior	Belief? ¹⁰			Performance in Past Month? ^a		
	Yes	No	Don't Know	Yes	No	
Avoid any tobacco use	168 (84%)	6 (3%)	26 (13%)	155 (77%)	45 (23%)	
Avoid drinking alcoholic beverages	83 (42%)	36 (18%)	80 (40%)	107 (54%)	92 (46%)	
Avoid eating meat of any kind	13 (6%)	67 (34%)	119 (60%)	13 (7%)	185 (93%)	
Eat an average of 5 servings a day of fruits and vegetables	144 (72%)	11 (6%)	45 (22%)	117 (58%)	73 (42%)	
Limit food intake to maintain current weight or lose weight	140 (70%)	12 (6%)	48 (24%)	130 (65%)	69 (35%)	
Take vitamin supplements	99 (49%)	21 (11%)	80 (40%)	151 (75%)	49 (25%)	
Take herbal supplements or remedies	48 (24%)	47 (24%)	104 (52%)	60 (30%)	139 (70%)	
Exercise at least 3 times a week for 20-30 minutes	149 (74%)	7 (4%)	44 (24%)	111 (56%)	88 (44%)	
Practice yoga or meditation	57 (29%)	43 (23%)	97 (48%)	32 (16%)	167 (84%)	
Use relaxation techniques	70 (35%)	39 (20%)	91 (45%)	64 (32%)	136 (68%)	
Receive massage therapy	43 (22%)	53 (26%)	104 (52%)	30 (15%)	169 (85%)	
Pray regularly	139 (70%)	23 (12%)	36 (18%)	164 (83%)	34 (17%)	
See a mental health professional	12 (6%)	106 (53%)	82 (41%)	16 (8%)	183 (92%)	
Wear protective clothing when out in the sun	112 (56%)	36 (18%)	51 (26%)	110 (55%)	90 (45%)	

¹⁰Data shown are frequencies and percentages

Table 3
Spearman Correlations of Breast Cancer Recurrence Risk Reduction Behavior and Beliefs, Worry, and Risk Perception^{1/}

Behavior	Beliefs	Worry	Risk Perception
Avoid any tobacco use	.22**	-.15*	-.09
Avoid drinking alcoholic beverages	.33***	.07	-.03
Avoid eating meat of any kind	.02	.10	.08
Eat an average of 5 servings a day of fruits and vegetables	.18*	-.04	.01
Limit food intake to maintain current weight or lose weight	.23**	-.11	-.16*
Take vitamin supplements	.40**	-.01	-.11
Take herbal supplements or remedies	.54***	-.05	-.11
Exercise at least 3 times a week for 20-30 minutes	.23**	.01	-.01
Practice yoga or meditation	.39***	-.05	-.11
Use relaxation techniques	.43***	.03	-.07
Receive massage therapy	.26***	.01	-.05
Pay regularly	.48***	.07	-.04
See a mental health professional	.26***	.19**	.14*
Wear protective clothing when out in the sun	.25***	.03	-.04

^{1/}*, p < .05; **, p < .01; ***, p < .001

Table 4
Multivariate Analysis of the Relationship between Breast Cancer Recurrence Risk Reduction Behavior and Beliefs, Worry, and Risk Perceptions^{1,2}

Behavior	Multiple R ²	df	Beliefs (β)	Worry (β)	Risk Perception (β)
Avoid any tobacco use	.077***	3, 195	.22**	-.16*	.00
Avoid drinking alcoholic beverages	.115***	3, 193	.33**	.08	-.07
Avoid eating meat of any kind	.014	3, 192	.01	.12	.01
Eat an average of 5 servings a day of fruits and vegetables	.032	3, 195	.18*	-.04	.04
Limit food intake to maintain current weight or lose weight	.082**	3, 194	.23*	-.07	-.13
Take vitamin supplements	.170**	3, 195	.39***	.04	-.09
Take herbal supplements or remedies	.289***	3, 193	.52***	.01	-.06
Exercise at least 3 times a week for 20-30 minutes	.056*	3, 194	.24**	.04	.03
Practice yoga or meditation	.161***	3, 194	.38***	.04	-.07
Use relaxation techniques	.187***	3, 195	.42***	.07	-.05
Receive massage therapy	.069**	3, 194	.25***	.13	-.05
Pay regularly	.227***	3, 192	.48***	.00	.01
See a mental health professional	.097***	3, 194	.25***	.10	.10
Wear protective clothing when out in the sun	.064**	3, 194	-.04	.06	-.04

^{1,2}*, p < .05; **, p < .01; ***, p < .001